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ABSTRACT

This publication contains energy education activities for grades K through 3 and is part of a set of three publications. These activities are organized under five energy concepts: (1) energy is so basic that nothing moves without it; (2) conservation of energy; (3) there are other energy alternatives; (4) society depends on energy; and (5) the production and distribution of energy have environmental and economic consequences. This publication is constructed in a looseleaf fashion to facilitate the reproduction of activities. Purpose, concept or objective, materials, and activity description are given for each activity. Activities involve students in games, values clarifications, and independent investigations. Activities may be selected and used in the curriculum as desired to achieve an interdisciplinary approach. (MR)

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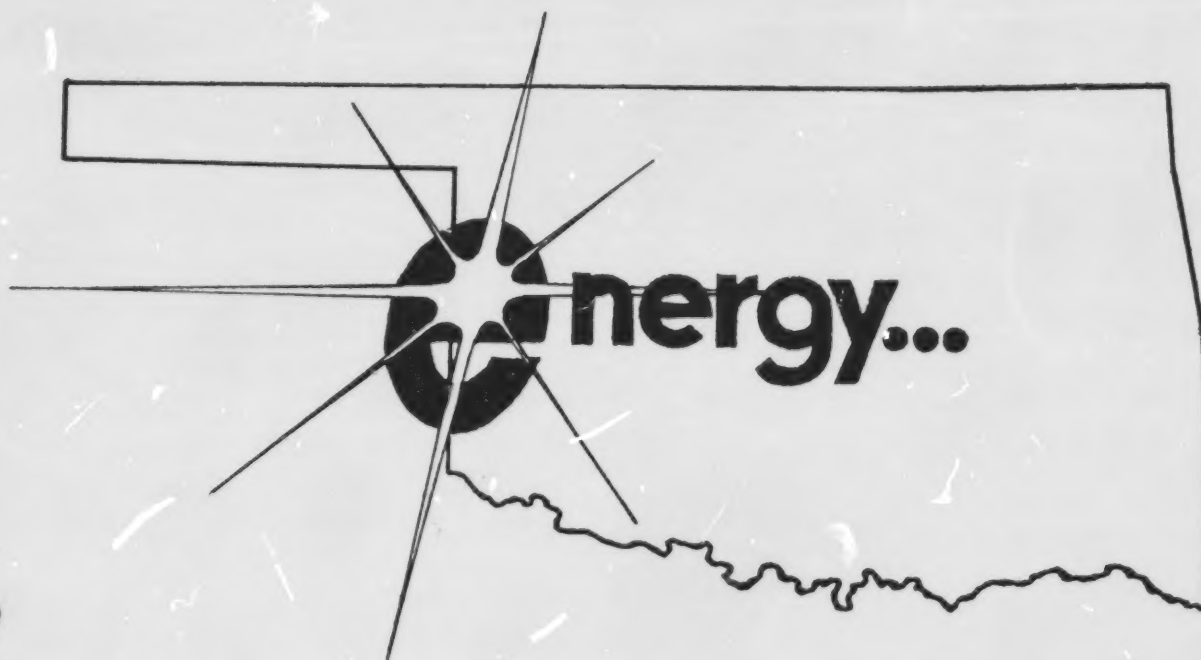


ENERGY AWARENESS EDUCATION Grades K-3

Oklahoma State Department of Education

Leslie Fisher, State Superintendent of Public Instruction

1977



OKLAHOMA ENERGY AWARENESS EDUCATION

ENERGY EDUCATION ACTIVITIES
Grades K-3

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Grades K-3

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CHAPTER XII

ENERGY EDUCATION CONCEPTS AND SELECTED ACTIVITIES Grades K-3

BASIC CONCEPTS FOR ENERGY STUDY

1. Energy is so basic that nothing moves or is accomplished without it.
2. Energy is a fixed commodity being neither created nor destroyed but converted from one form to another. The means of conversion and the by-products of this conversion are important.
3. Presently, most of our energy requirements are met through using fossil fuels. However there are other alternative sources of energy such as solar, wind, fission, fusion, hydrogen, hydro, and geothermal, which must be considered and developed.
4. Energy, its production, use, and conservation are essential in the maintenance of our society as we know it.
5. The production and distribution of energy have environmental and economic consequences.

modified from Mengel, Wayne. Energy: Key to the Future. Dutchess County Board of Cooperative Educational Services, Poughkeepsie, New York, 1974, ED 092 395.

STUDENT ENERGY INVENTORY

Grade Level K-1

Purpose: Energy in various forms is used by us every day.

Concept: Energy comes in various forms.

Materials: Energy Inventory Sheet, various toys

Activity:

1. Introduce concept of energy by providing examples of activities that use energy.

Play Simon Says with class doing simple motions such as tapping foot, clapping hands, patting top of head, rubbing stomach, etc. After about three minutes, ask students to name some of the actions and record these or make stick drawings of these on the board. Tell class that when they did these activities they were using energy.

Plug in several electric or battery-powered toys and ask students what makes them move. Plug in blinking Christmas lights and ask students what makes them light and blink. (Possible answers: energy, battery, wires, electricity, etc.)

Wind up several toys and watch them move or push a toy car or truck and ask what made them move. (Possible answers: we did, our muscles, our energy, I pushed it.)

Lead students to observe that people, electricity, etc., that make things move, use energy.

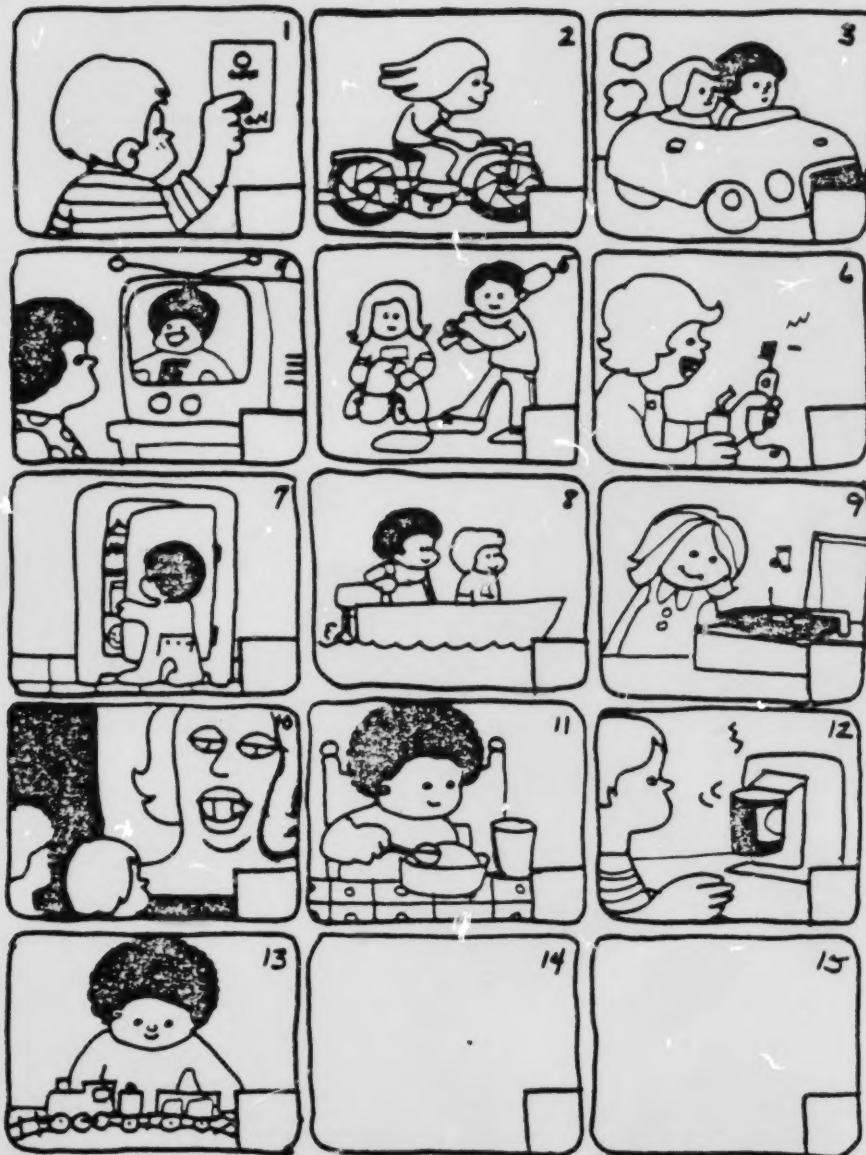
2. Have students identify the ways they use energy in their daily lives--with the energy inventory sheet, "How Do You Use Energy?"

"Let's look at the pictures on this page. What is happening in picture number one?" (Boy is pushing on light switch.) "Have you turned the light switch on or off at home? What happens when you do?" (Lights go on or off.) "When we turn on our lights, we are using energy. Let's put a check (✓) in the box to show one way we use energy."

"Let's look at the next picture. What is happening here?" (Girl is riding bicycle) "How many of you have ridden a tricycle or bicycle? When we use our muscles to do things, we are also using energy. So if you ride a bicycle or tricycle, put a check (✓) in the box by this picture."

Have students observe and identify other ways they and other people use energy at home, in school, on the street, for entertainment, and at work, using Energy Picture Book I (pp. 92-104).

Energy Inventory Sheet



WIND AND ENERGY

Grade Level K-1

(These activities require no reading skills)

Objectives:

1. Students will participate in activities which create an awareness of kinds of energy.
2. Students will participate in activities which demonstrate energy conservation.

Activity:

A. The Wind as an Energy Source

1. Make a matchbox boat with a paper sail. Sail it outdoors, if possible, or put it in a pan of water, and create the wind motion by blowing.
2. Discuss ships such as the "Mayflower" and how the wind propelled them. Ask what the children believe happened when it was very calm and the wind was not blowing. What kind of energy do modern ships use?
3. If an outdoor space is available, wash by hand, some paint smocks, etc., then dry them (on a line outdoors) by the wind. Bring in the absence of washing machine power and dryer power to do these two tasks. Discuss how people of long ago washed and dried their clothes.
4. Make a windmill from a milk carton and construction paper. Talk about Holland and their windmills. Tell how windmills are used for irrigation of orchards in the West. Discuss the advantages and disadvantages of relying solely on wind power.
5. Look in a reference book (Precyclopedia) and find out how the wind helps scatter seeds such as the Norway maple, etc. Talk about the energy a farmer uses in planting large fields of crops.
6. Write a letter (dictated by the students to the teacher or aide) and place it in a plastic envelope. Attach it to a gas filled balloon and release it. When the finder answers the letter, use a map to determine where it landed, the direction of the

location in relation to the release point, how far and how long it took. This would suggest prevailing wind direction.

7. For Art activities which demonstrate wind energy, place a large human figure on the bulletin board. Have each child draw, color and cut out a hat. Scatter them around the figure.

Discuss the belief that if March comes in like a lion, it will go out like a lamb, or vice versa. What are the implications? Would March be a good month for our area to plan to use wind power? Make a bulletin board display of a popcorn lamb and a paper plate and construction paper lion.



B. Let's Pretend

1. In a discussion group, pretend we have no television, stereo, or radio. Ask the children to describe activities they might do instead of watching TV or listening to the radio or the stereo. (Emphasize that energy plays little or no part in most of the activities.)

ENERGETIC BALLOONS

Grade Level K-3

Objective: To demonstrate the principle that energy must be used to set an object in motion.

Activity:

1. Allow students to blow up balloons and release them.
2. Stretch strings across the room so that they are parallel. Tie both ends securely so that there is no slack in the string. By means of tape, attach the balloon to a length of straw. The larger the diameter of the straw, the better. Also, the "hot dog" type of balloon works best. Allow groups of students to "race" their balloons.

Suggested questions for class:

What makes balloons move?

Where does the energy come from to move the balloon?

Put energy into a balloon by blowing it up. Twist the end to contain the air. Now where is the energy? (This is an excellent time to discuss potential and kinetic energy.)

Does design of the racers affect its speed?

How can you make a balloon travel faster?

Extended Activities:

1. Fill a balloon with helium. Discuss blimps and helium balloons and how and why they operate. Are they a practical form of travel? Are dirigibles a convenient form of travel? What about cost? Construct a model dirigible. Research the "Hindenberg". Is hydrogen still used for dirigibles?

PEOPLE USE ENERGY

Grade Level K-3

Purpose: Our society is an energy consuming one.

Concept: Energy is used by everyone.

Materials: Energy Picture Book I

Activity:

1. Have students identify how they and other people use energy.

Introduce and distribute Energy Picture Book I. Allow students to skim through the pages. Then ask:

"What do you think this book is about? (List ideas.)

If students can read, have them read the title page. "Everywhere we look, people are using energy." Briefly discuss the meaning of this.

Then carefully examine each set of pictures and identify the energy users. Students may circle, or place a check mark, or a red dot on each energy user. Also identify a few non-users of energy for contrast. Examples of non-energy users in the At Home series would be the picture on the wall, the shovel, the suitcases, etc. Mark as many of the pages as are appropriate for the age level, ability, and attention span of your group. Take sufficient time to examine the pages carefully and answer any questions. After completing one or two with the class, allow students to mark the next set(s) themselves.

2. Summarize lesson.

Review and discuss the energy users in the sets completed. Have students name 3-5 energy users. Allow students to color their favorite parts or draw other pictures of how they and others use energy. Add this section to their folders.

BOOK ONE



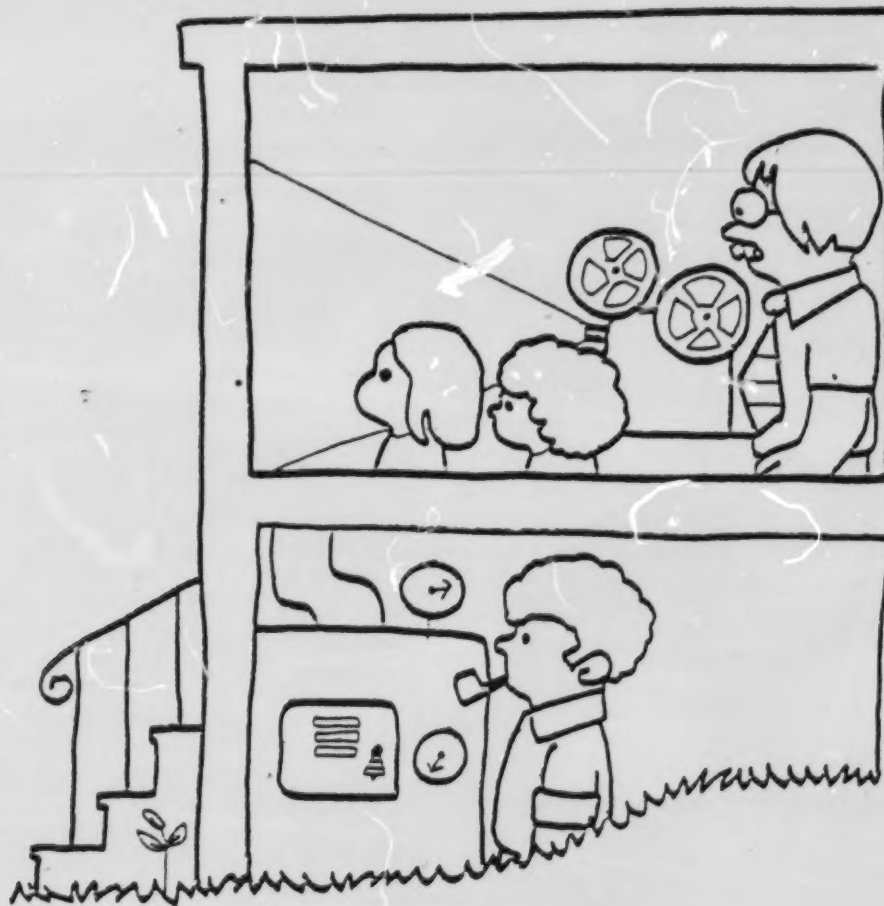
EVERYWHERE WE
LOOK... PEOPLE
ARE USING

ENERGY!



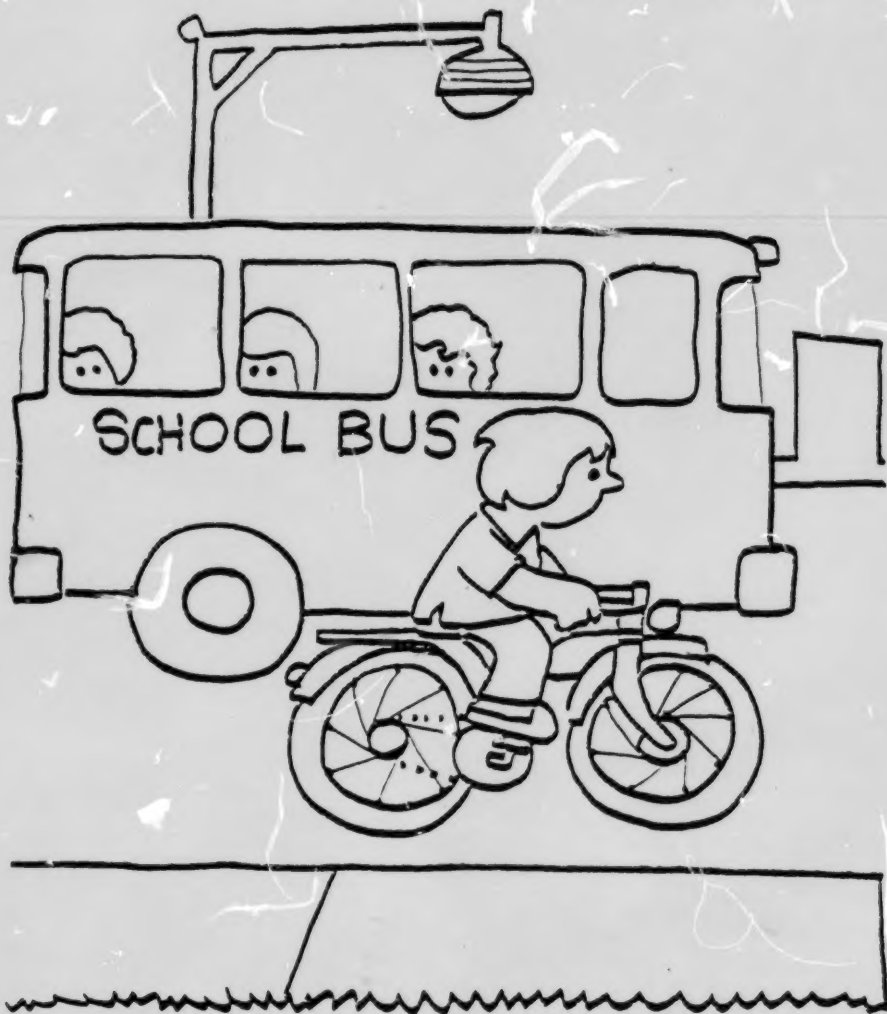


...at school





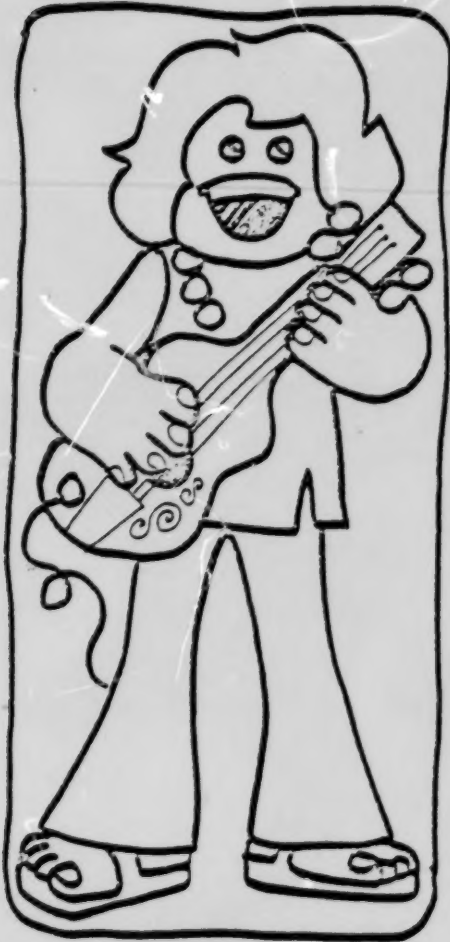
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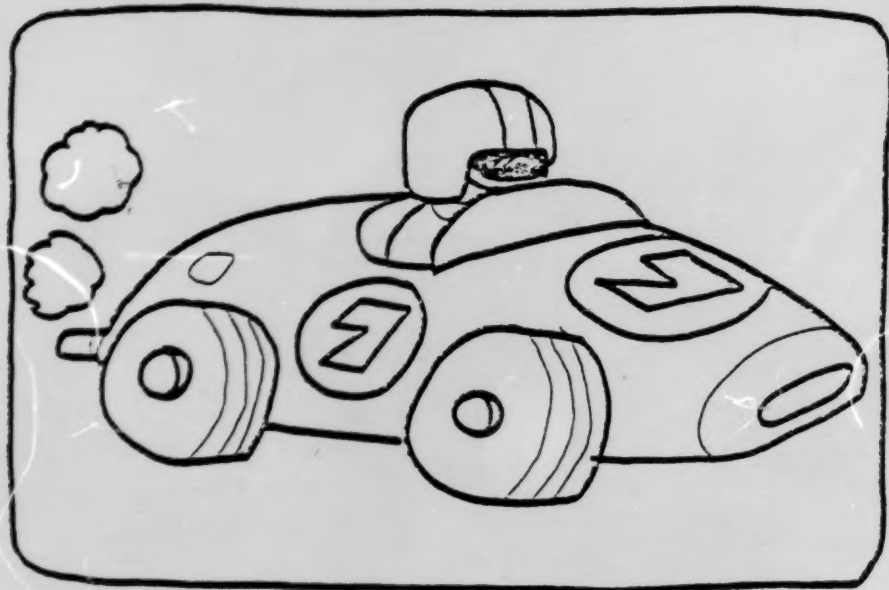
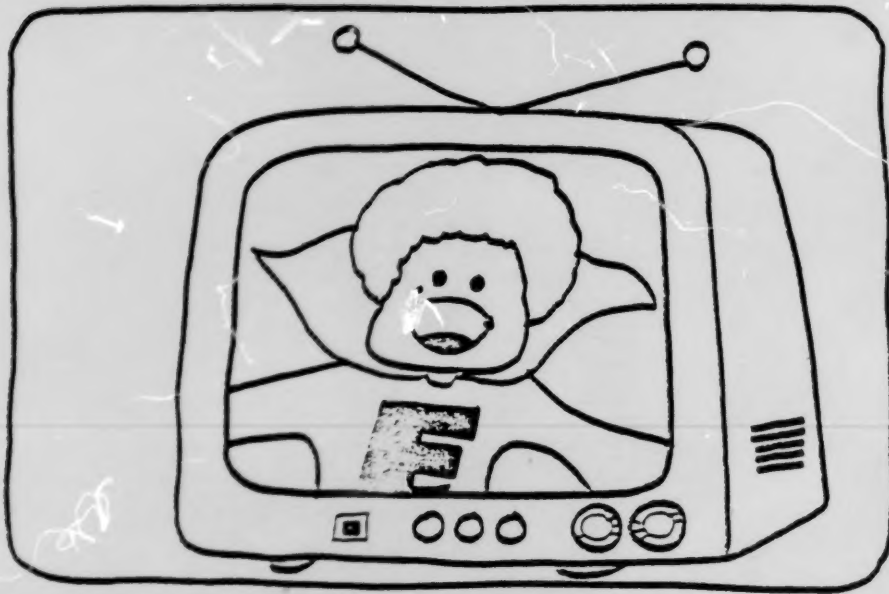


street



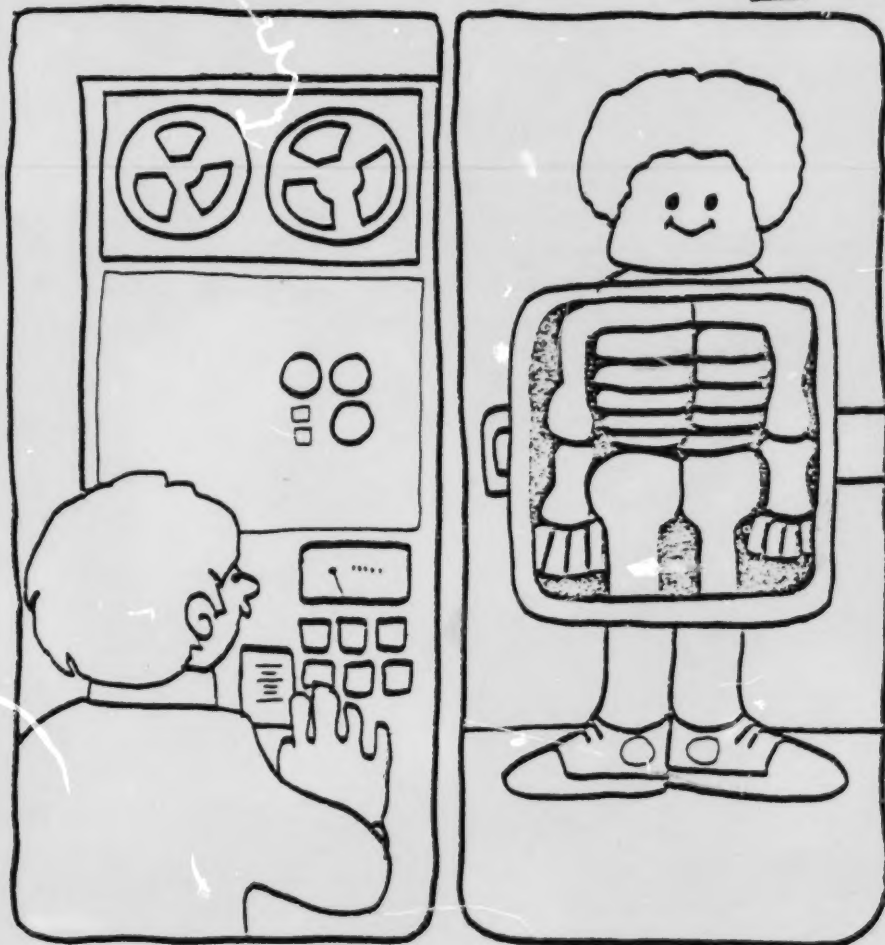
...far fun



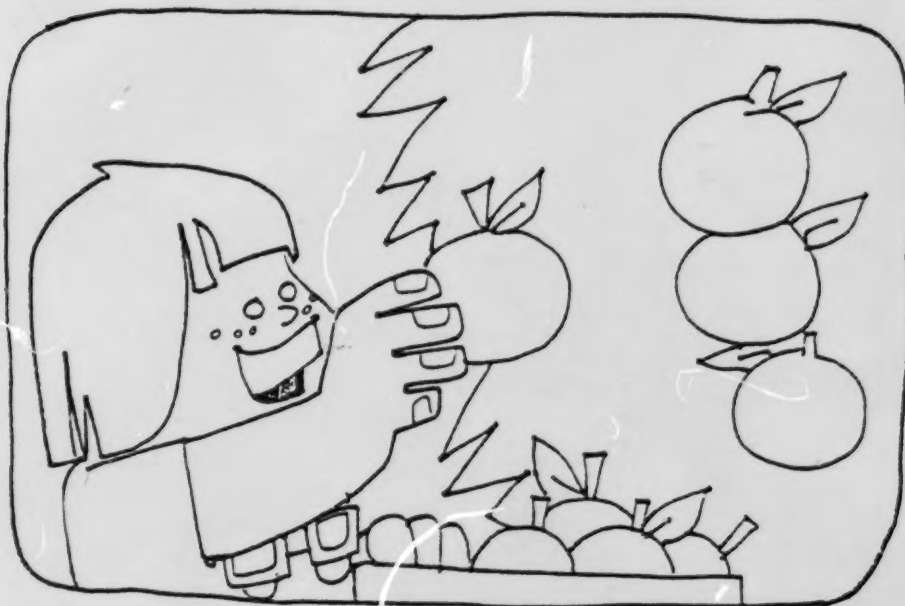


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...at work

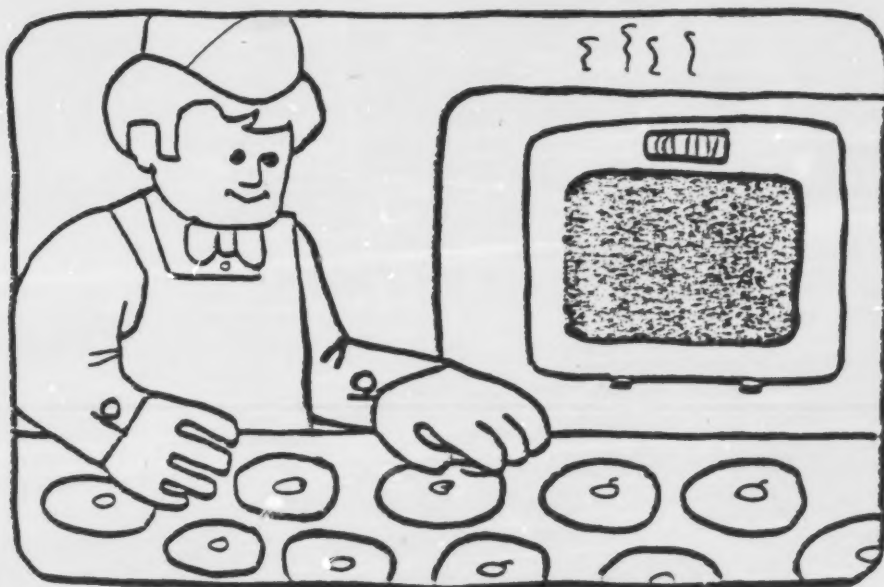


101



...in industry





ENERGY AS HEAT, LIGHT, AND MOTION

Grade Level K-3

Purpose: Students will recognize various forms of energy.

Concept: Energy can be seen as light, motion or heat.

Materials: Energy Picture Book 2

Activity:

1. Distribute copies of Energy Picture Book 2. Read and discuss title page. Have students identify three qualities of energy--heat, light and motion--by examining the pictures and offering their own examples. Develop the meaning of the terms heat, light, and motion by discussing pictures.

2. Have the students orally or in writing compose a statement for each picture. Examples:

Energy Moves Things--"The man's muscles are moving the chair." "The water is turning the water wheels."

Energy Heats Things--"The sun's energy is heating and tanning the person." "The coal in the furnace is being burned and is heating the house."

Energy Lights Things--"Electricity lights the TV sets." "Using a form of light, the x-ray machine can take pictures of the bones in our bodies."

Students may want to copy these sentences onto the pictures or write them on a separate piece of paper and paste them below the pictures.

3. Summarize the lesson. (Energy use is connected with heat, light, and motion.)

Have students orally or in writing complete this statement:

"Energy can (heat), (light), or (move) things."

Have students draw other examples of energy moving things, energy heating things, and energy lighting things.

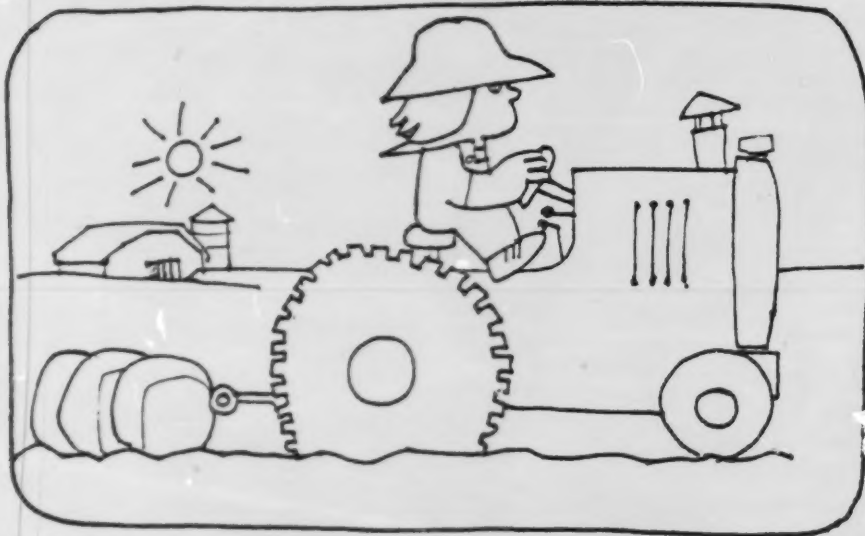
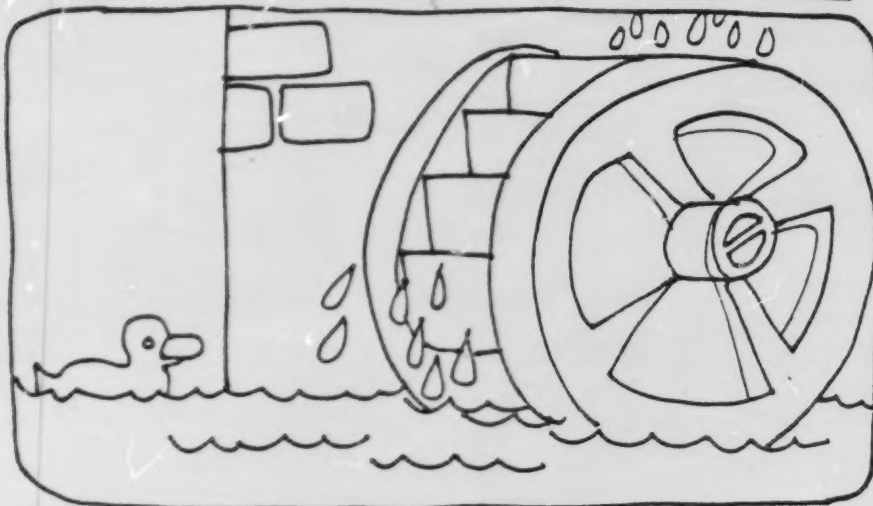
Students may want to color their favorite pictures. Add this section to their folders.

BOOK TWO

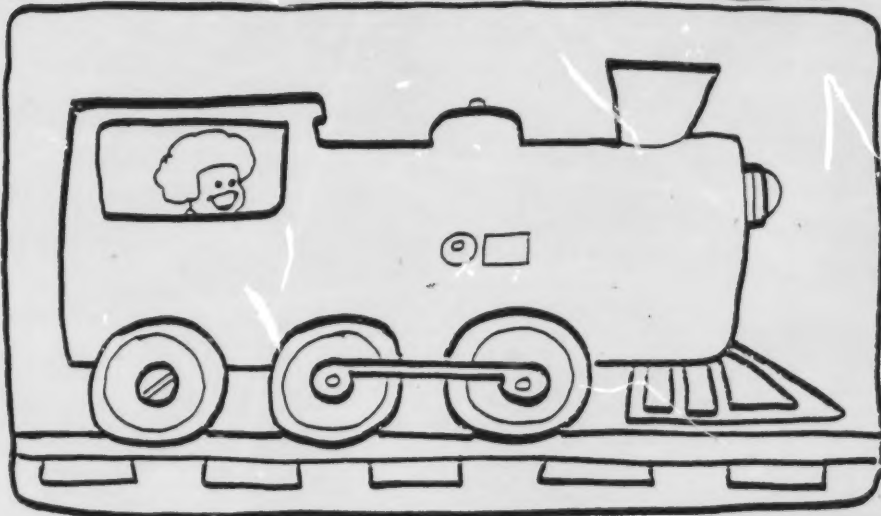


WE KNOW
ENERGY
BECAUSE OF
WHAT IT DOES

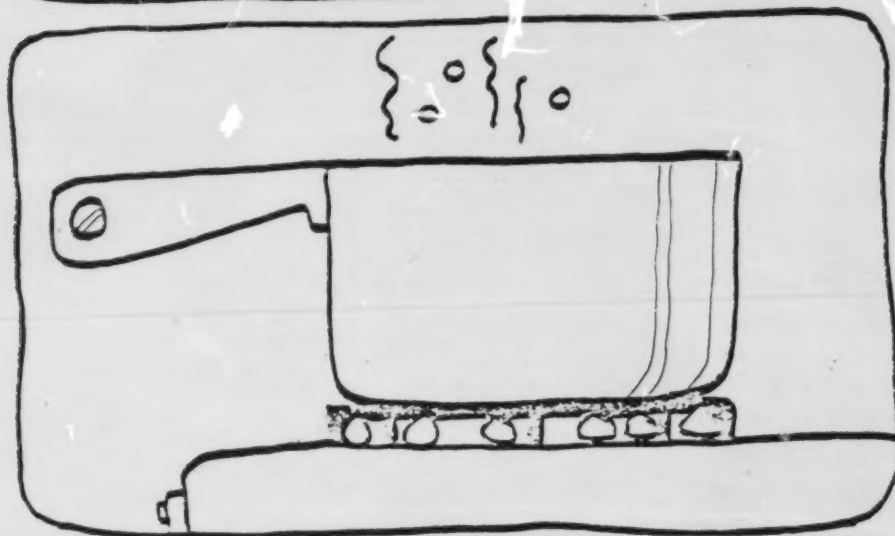
ENERGY



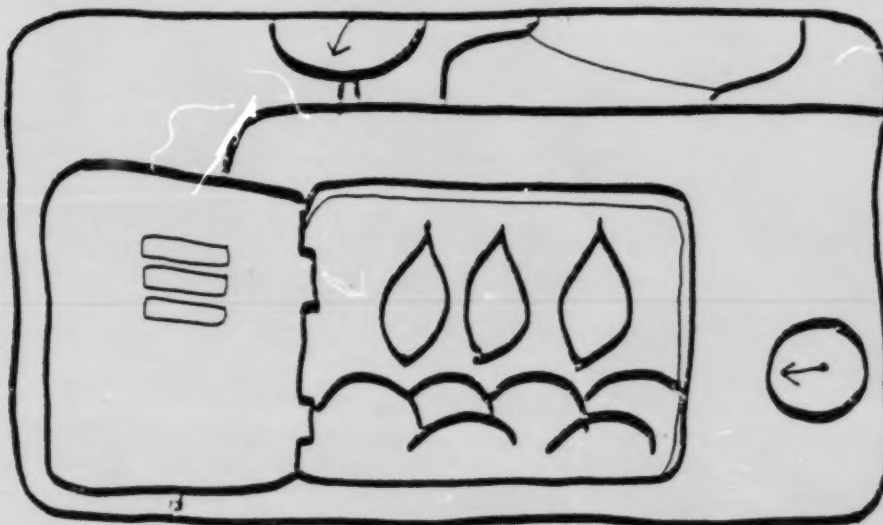
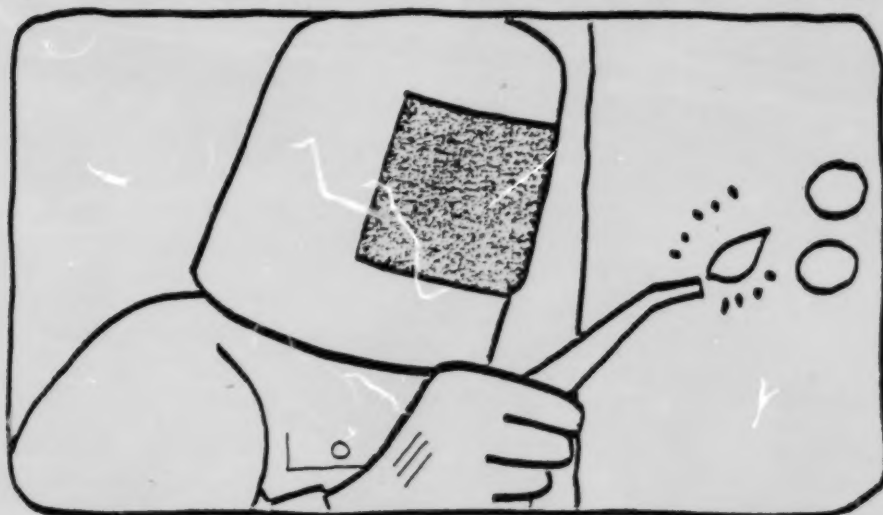
MOVES + things



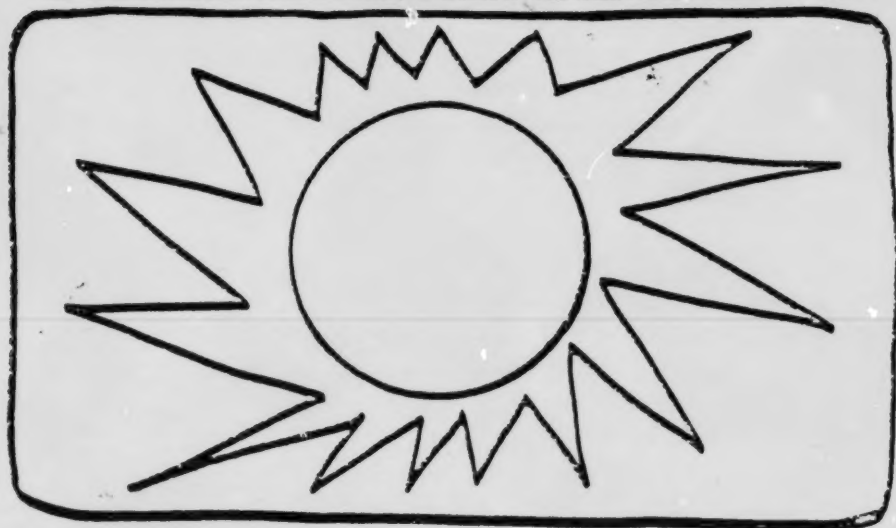
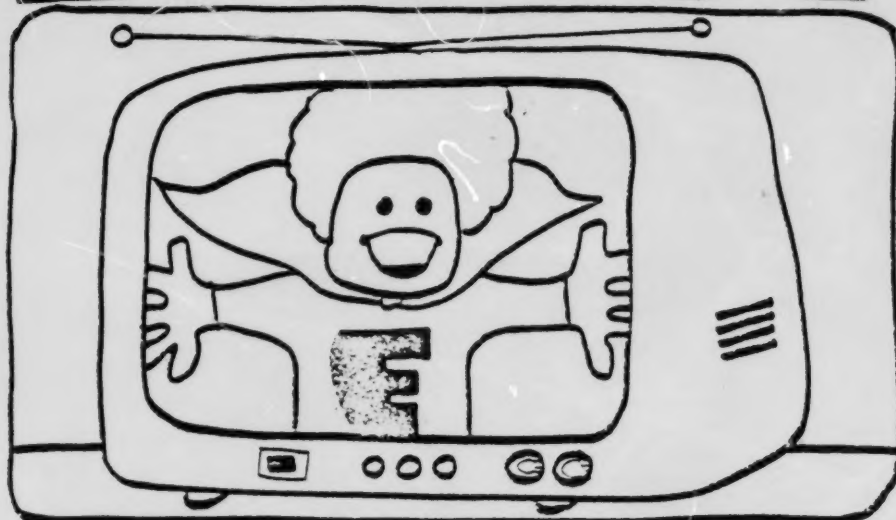
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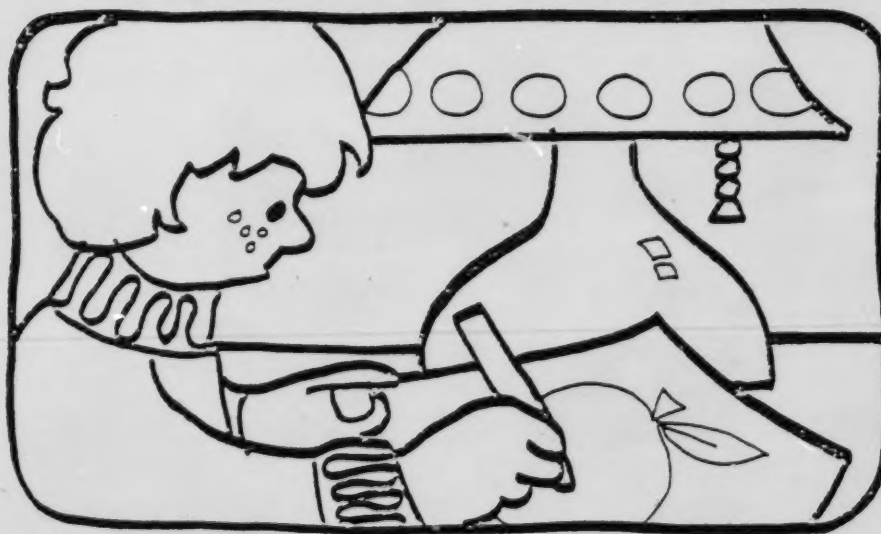
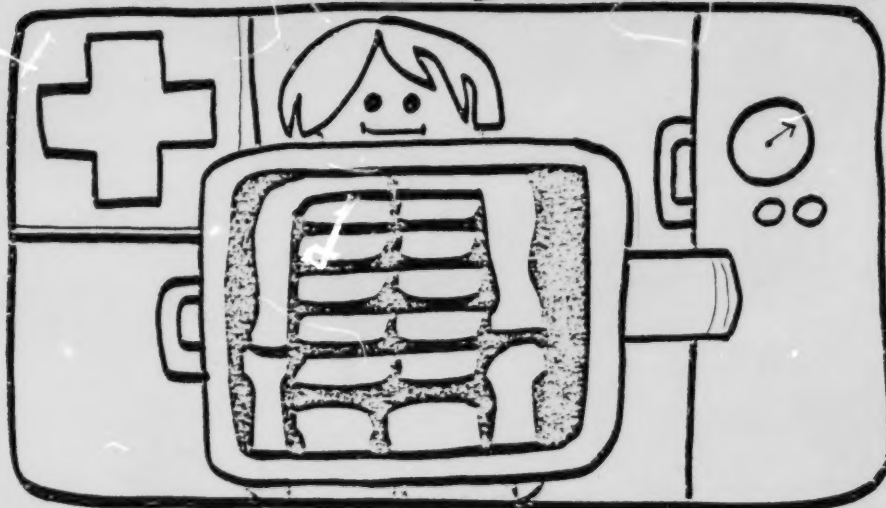
Heats things



ENERGY



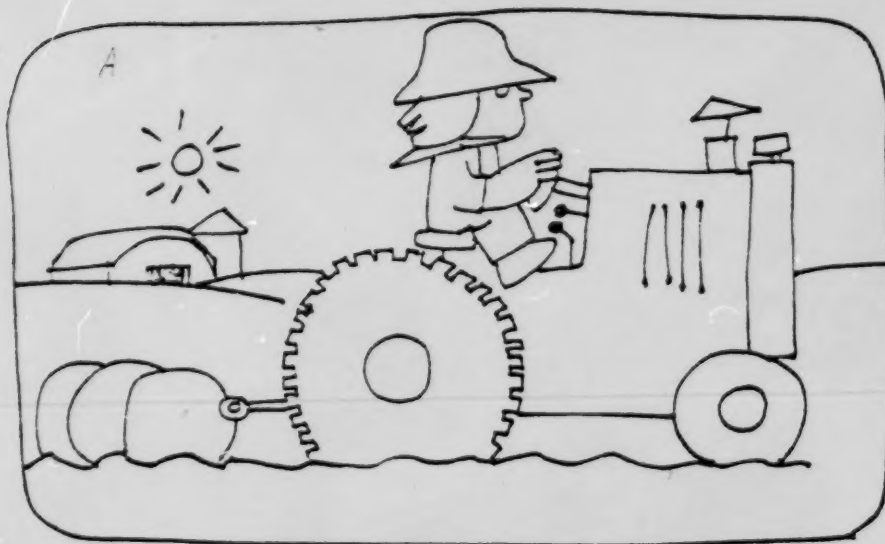
lights things

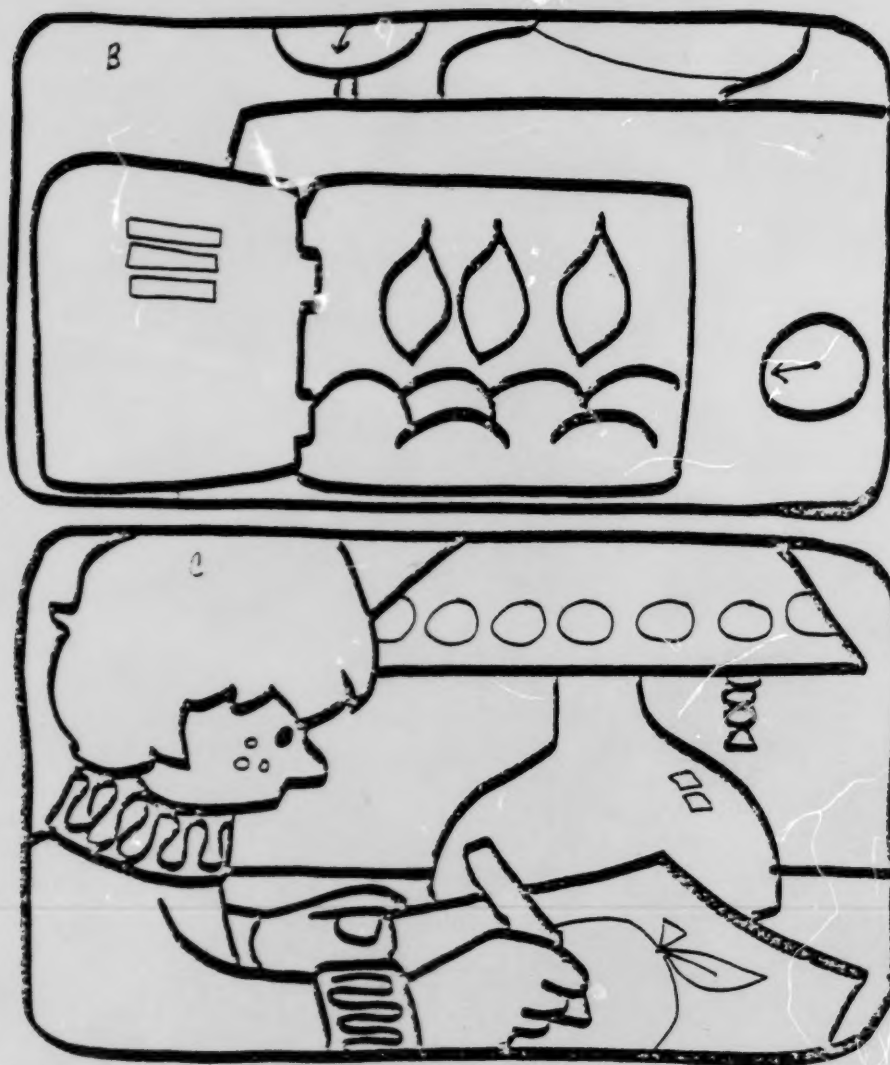


ENERGY IN USE

Look at each picture and decide how energy is being used. Write A, B, or C by the correct form of energy:

- _____ 1. Motion
- _____ 2. Heat
- _____ 3. Light





ENERGY SOURCES

Grade Level 2-3

Purpose: Students will have an awareness of where energy comes from.

Concept: Energy comes in several forms.

Materials: Energy Picture Book 3, bunsen burner or propane torch, safety goggles, bicycle pump

Activity:

1. Title Page

Either read the title page to students or ask:

"What does the title say? What does the E on our symbol stand for? (Energy) (Students may want to name the energy symbol.) Does anyone know what natural gas is? (Colorless, odorless, air-like substance that can burn.) Do any of you have gas stoves or hot water heaters at home? Describe how they work."

(Optional: Light a bunsen burner or a propane torch for students to observe gas burning. Use safety goggles.)

2. First Page

"What is this a picture of? (Gas well) How do we get gas from the ground?" (Briefly mention drilling a hole and using pipes to get gas from the ground.)

3. Second Page

"What does this title say? (Pumping station) What is a pump?" (Refer to bicycle pump or demonstrate the use of one. A straw in a milkshake cup could also be used to give students the concept of a pump.) "We use pumps to move the gas along the pipeline."

4. Third Page

"If we have too much gas, we store it underground in tanks until we are ready to use it. How does gas get to your house or our school?" (Pipes)

5. Fourth Page

"What is shown in this picture? (Gas meter) What does it tell us?" (It tells how much gas we use.) If possible, observe the school's gas meter.

6. Fifth Page

"What is shown in each picture?" (Gas is used to help make such items as synthetic materials and plastics.)

7. Sixth page

"What does the title tell us?"

Discuss the forms of energy in terms of the heat, light, and motion which they directly or indirectly provide. For example: oil-heat, gasoline for cars, etc. Explain that they will learn more about these forms as they proceed through the unit.

8. End lesson by summarizing the process shown in the series.

Review process developed with students (i.e., gas well → pumping station → underground storage → homes and businesses → products and uses). Again, students may write sentence captions for each picture or develop these as a class and copy each under the appropriate picture. Students may color favorite parts and add these sections to their folders.

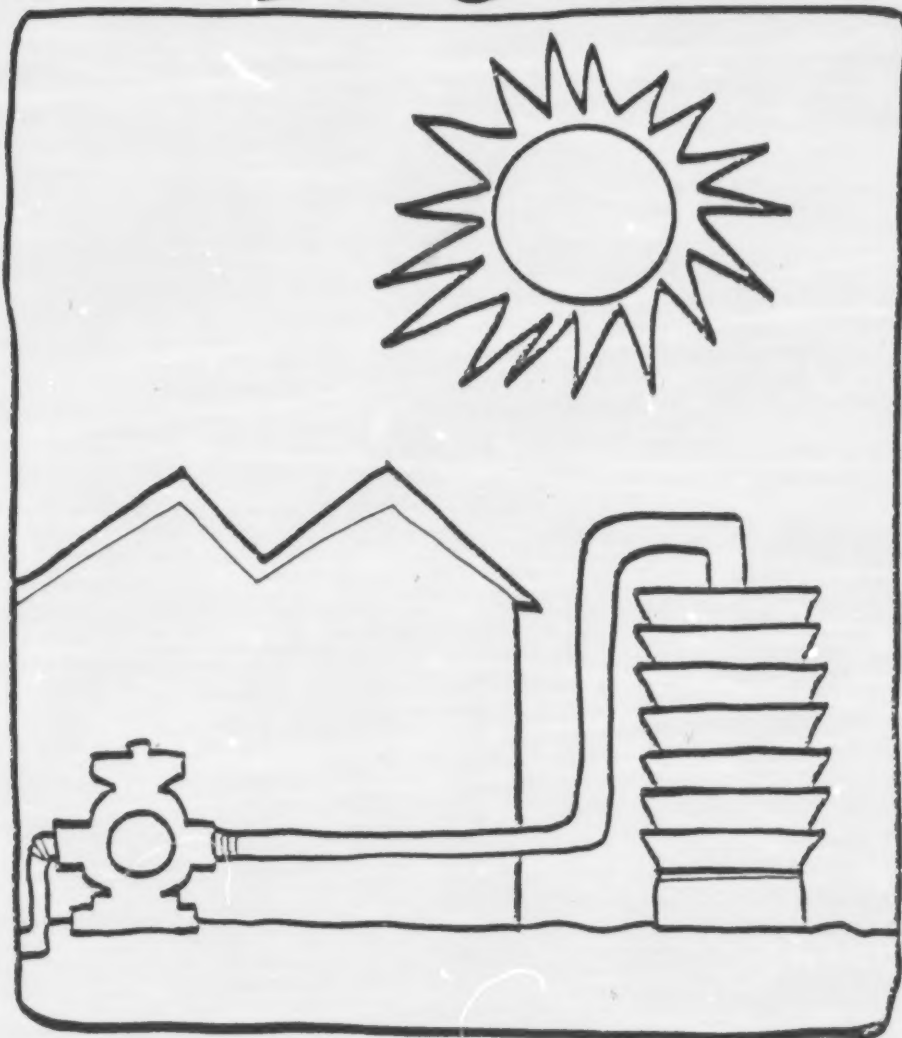
BOOK THREE

NATURAL
GAS AND
ENERGY

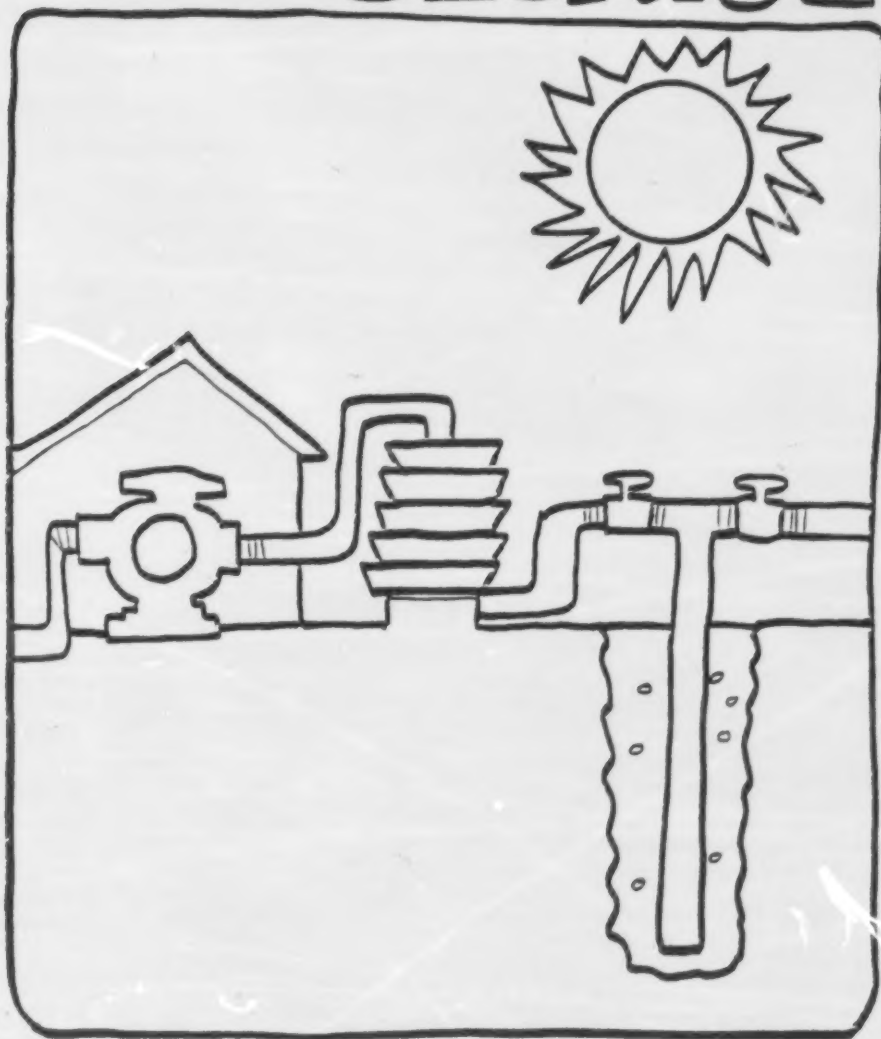
GAS WELL



Pumping station



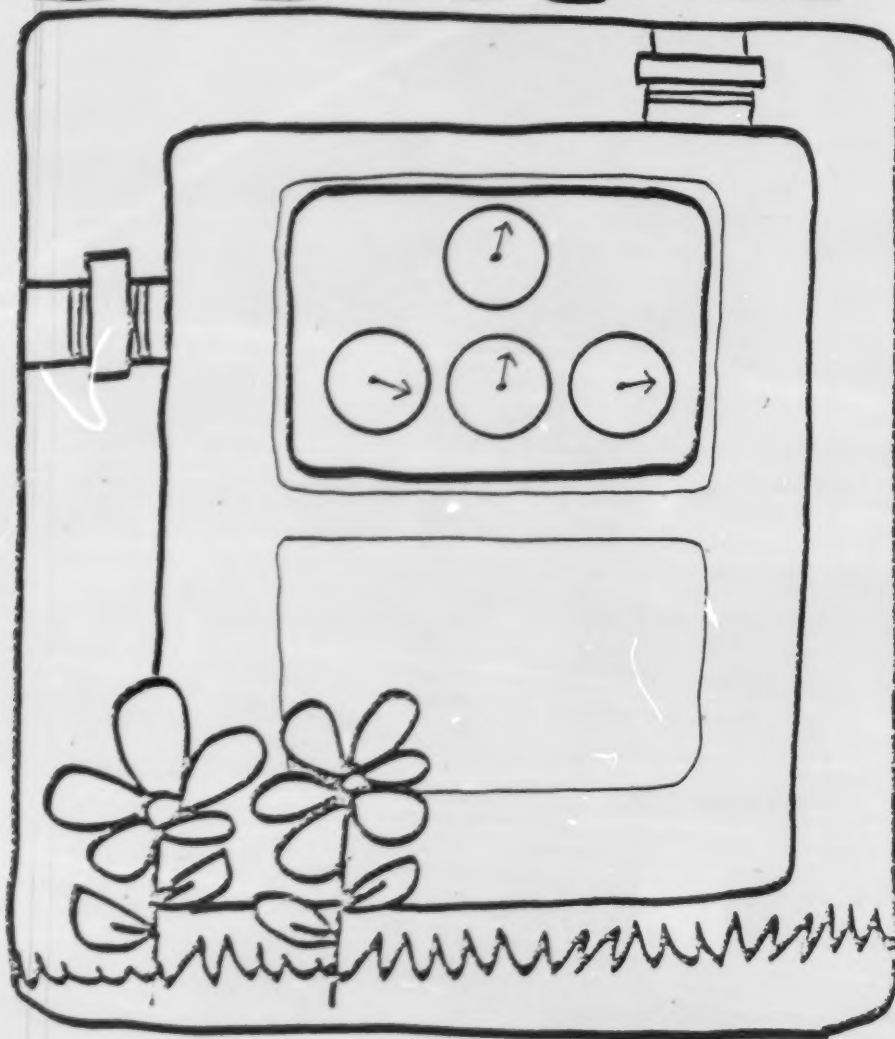
underground Storage



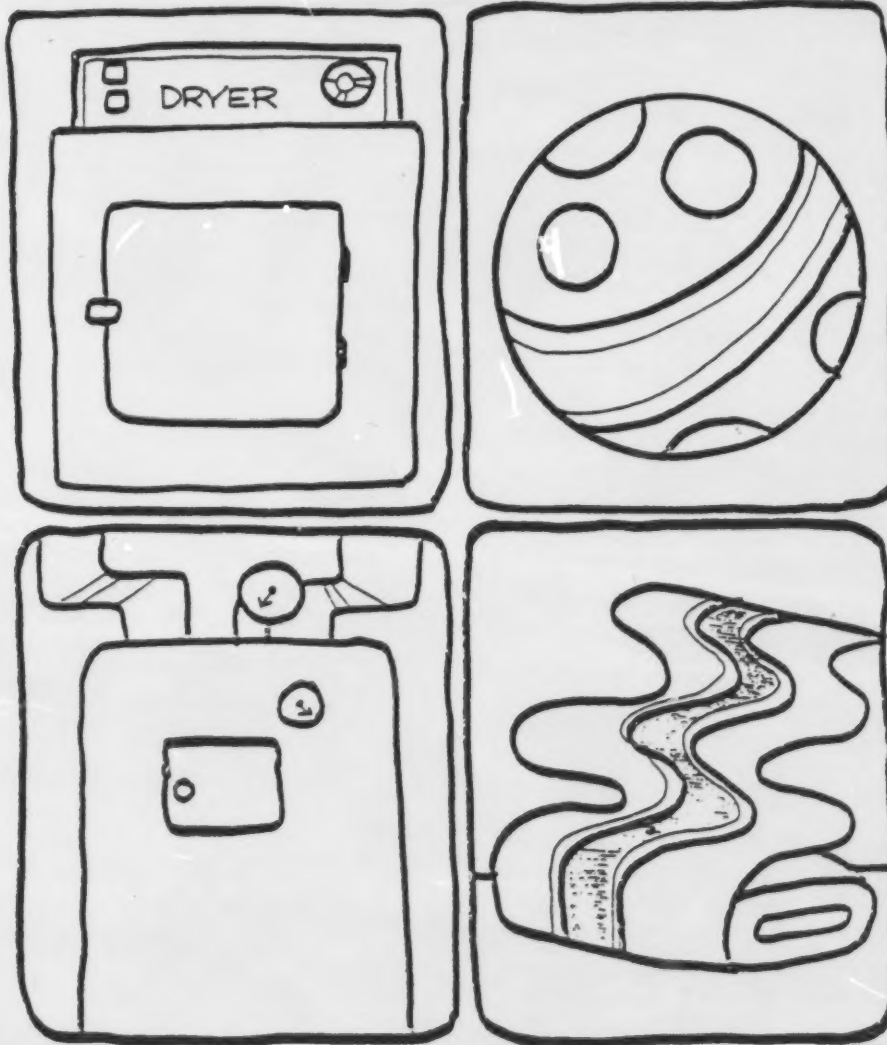
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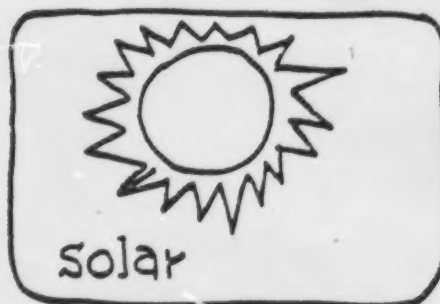
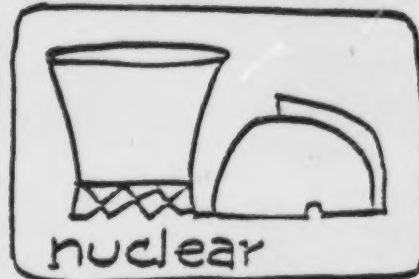
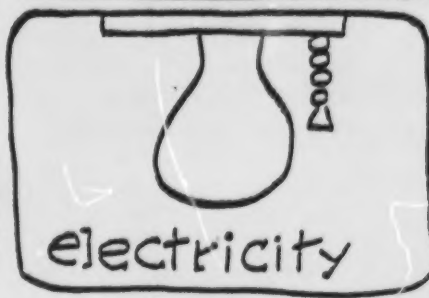
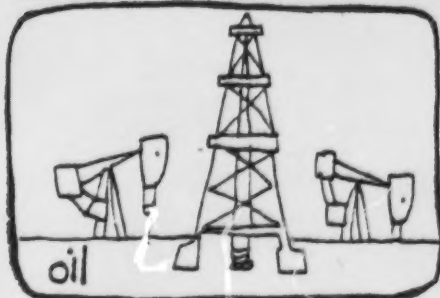
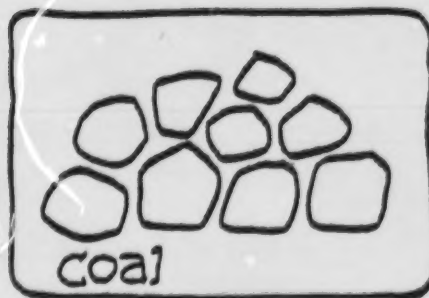
GAS METER



natural gas uses



Other Forms of ENERGY



ENERGY STAMPS

Grade Level 2-3

Purpose: To enable students to see how energy is transformed for our use.

Concept: Energy is converted to meet our needs.

Materials: Scissors, paste

Activity:

1. Review route and sequence of natural gas series. Begin lesson by distributing Energy Stamp Sheet 1 for natural gas series. Have students cut out and paste the stamps in the correct spaces. Allow about 5 minutes to complete the activity, then discuss and correct the sequence.
2. Generalize sequencing concept by introducing food chain stamps. Ask students where people get their energy and see if they can trace it to the sun. Example: People--meat and vegetables--sunlight. Pass out Energy Stamp Sheet 2, Food Chain, and allow student to cut, paste, and complete this picture. Discuss and correct this sequence.

Allow students to color Energy Stamps and place these in folder.

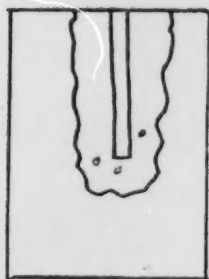
3. End lesson by forming groups of students to study other forms of energy.

Write other sources of energy on the board.

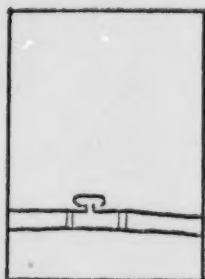
Coal	Oil	Electricity
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Allow students to choose the form they would like to investigate. Electricity series is best for more able students, because it is an intermediate form of energy using a variety of basic fuels.

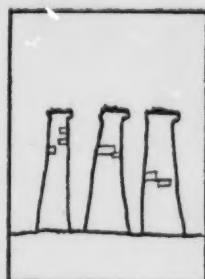
ENERGY STAMPS



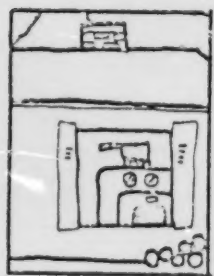
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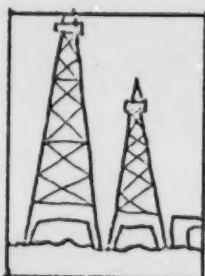
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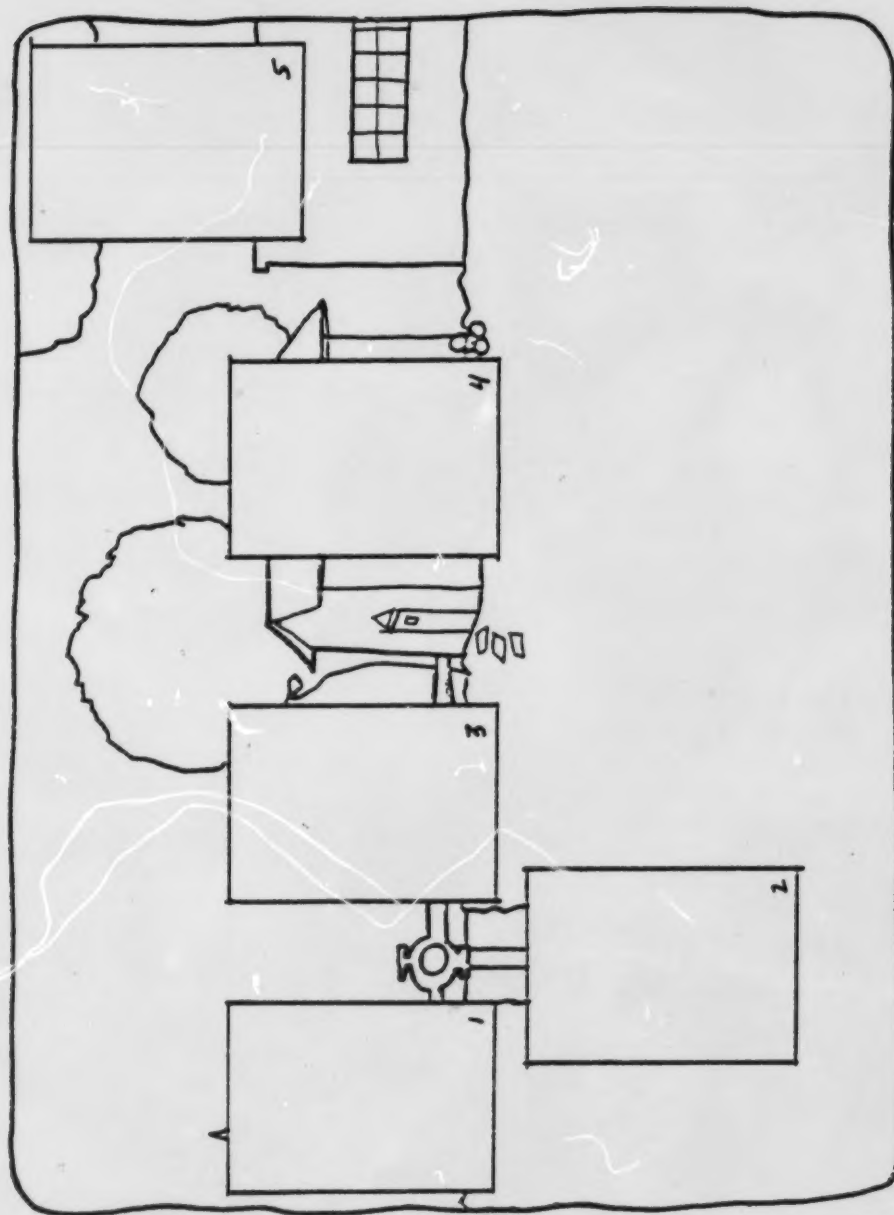
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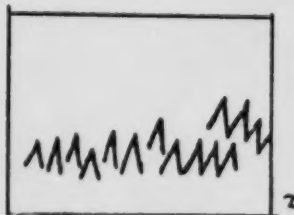
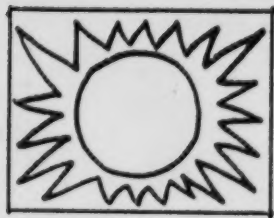
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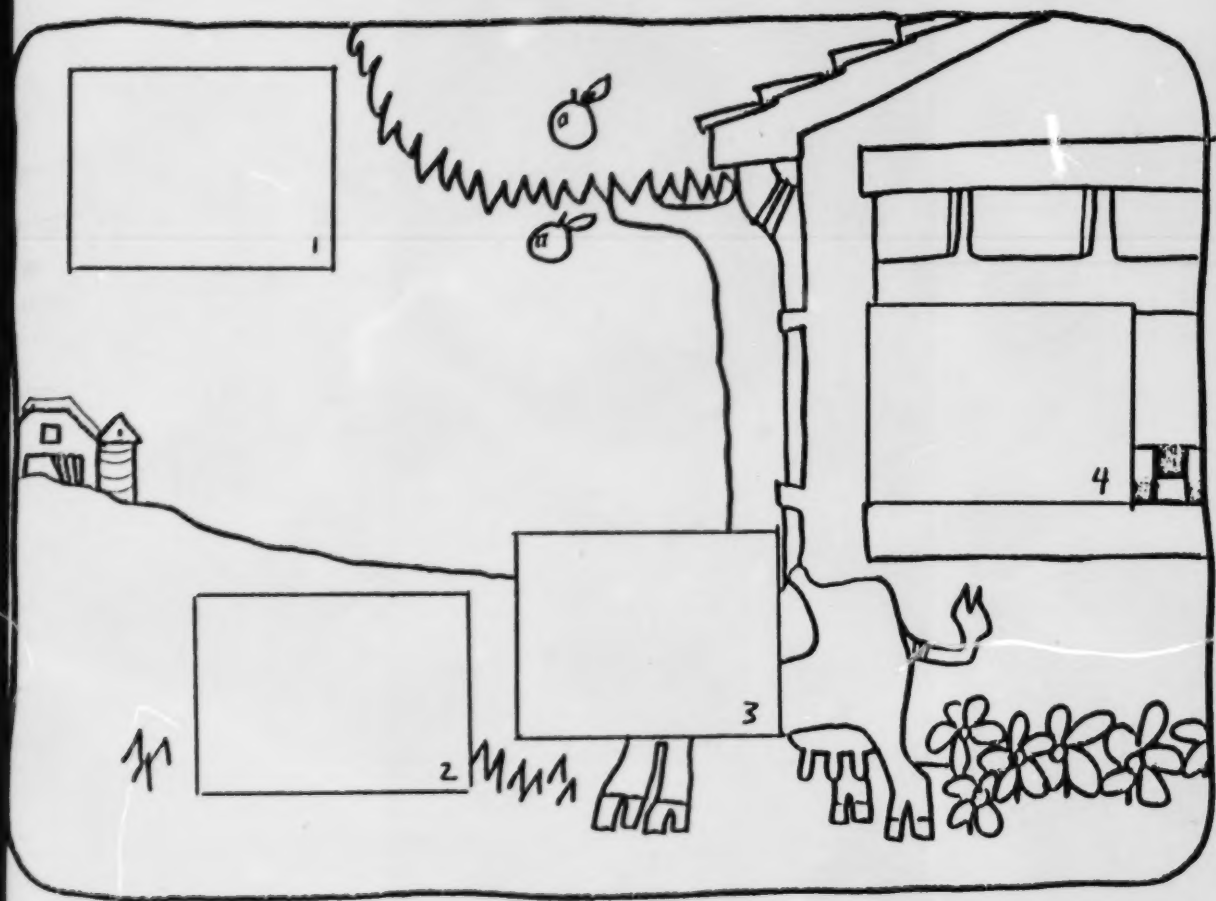
natural
GAS



ENERGY STAMPS



the FOOD
CHAIN



OIL

Grade Level 2-3

Purpose: To have students observe what oil is.

Concept: Fossil fuels provide most of the energy we use.

Materials: Energy Picture Book 4, samples of oil, Oil Energy Stamps

Activity:

1. Title Page

"Describe oil." (Liquid, brownish-blue to clear in color, thick like cream) Obtain sample of oil for students to touch and smell.

2. First Page

"What is shown in this page? (Oil wells) Is the land hilly or flat? (Flat) Where is the oil that we find? (Underground) How is the oil removed?" (Pumped through pipes) Remind students of examples of pumps discussed for natural gas book.

3. Second Page

"What is shown on this page? (Boat, ship, or tanker) How is an oil tanker used?" (To carry oil from place to place)

4. Third Page

"What has happened here? (Oil has spilled on the water) Is this harmful? To whom? (People, marine plants, and animals) Would it be difficult to clean water with oil on it?" Have students examine an oil spill by pouring some oil into a pan of water.

5. Fourth Page

"What is a refinery? (Place where crude oil is changed into different oil products, such as gasoline, heating oil, asphalt, etc.) Trace where crude oil comes in, tell what happens and show where it leaves."

6. Fifth Page

"How does the oil get from the refinery to the gas station? (Trucks) Where might these trucks take the oil?" (Homes, businesses, gas stations, etc.)

7. Sixth Page

"Name some of the uses of oil shown on this page. Oil helps make asphalt roads, oil products make new materials for sporting goods and clothing, oil is changed into gasoline for cars, trucks, etc." (Make display of products made from petrochemicals)

8. Seventh Page

"What happens when gasoline is burned? (Smoke comes out the car exhaust) Is it good for people to breathe this? Why or why not?" (Harmful to lungs)

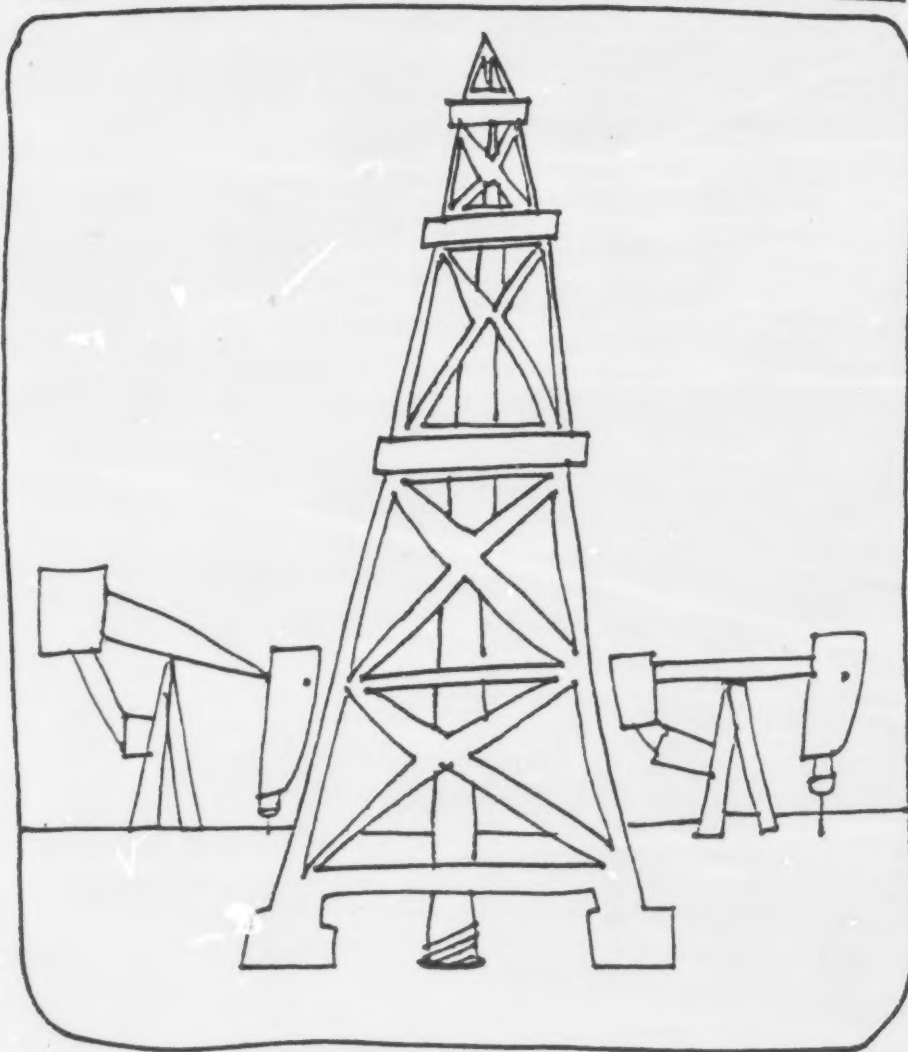
Review vocabulary. Have students place a check by the forms of energy they have studied so far.

End lesson by allowing students to color favorite parts and add section to folder.

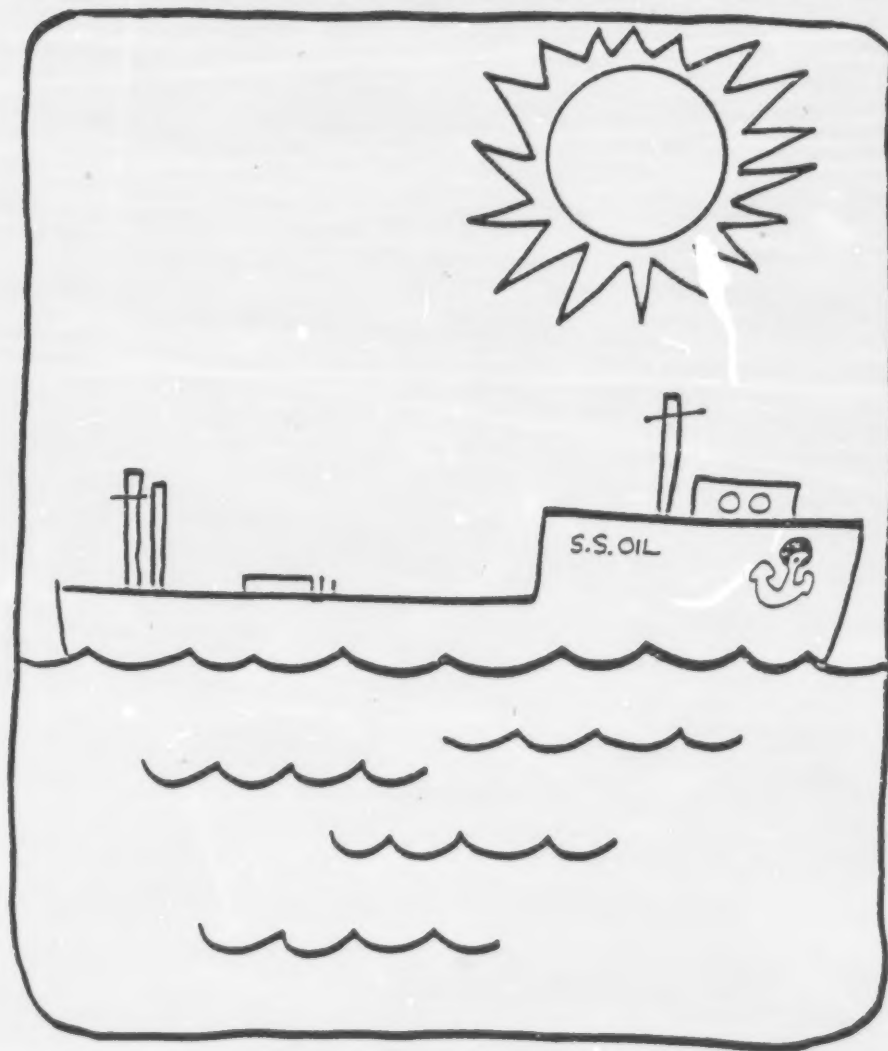
Next day have students complete Oil Energy Stamp sequence.



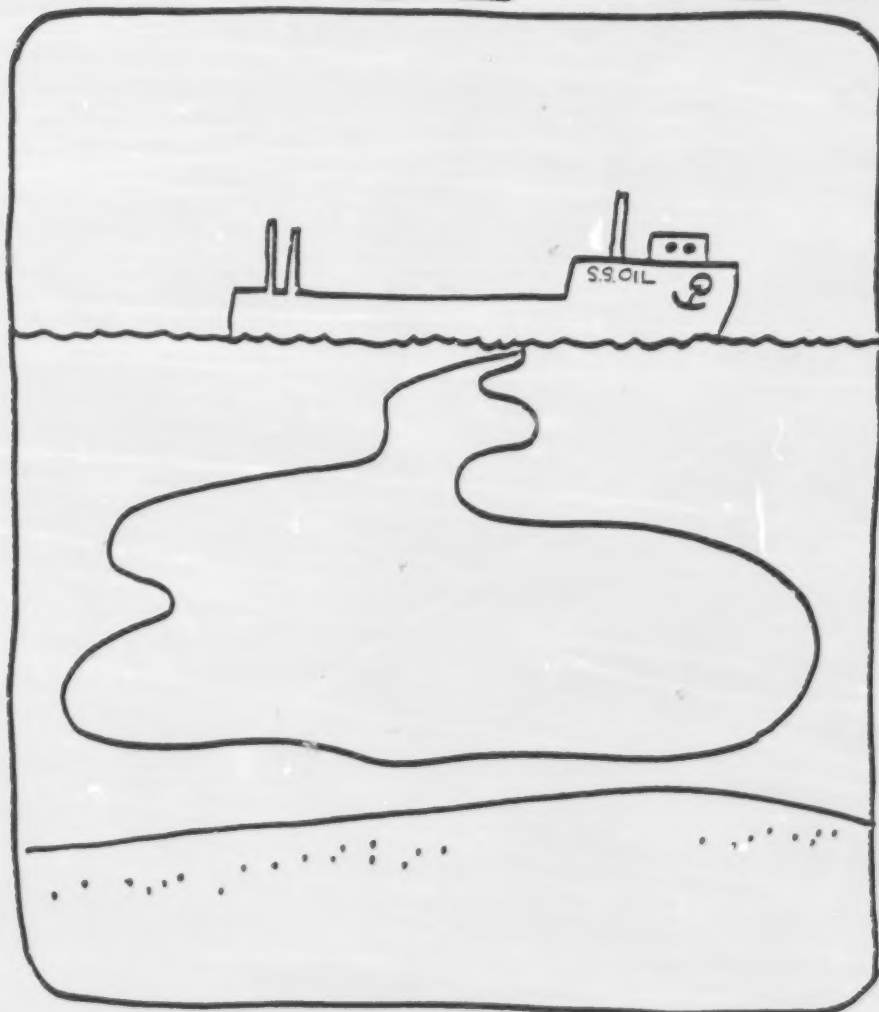
oil field



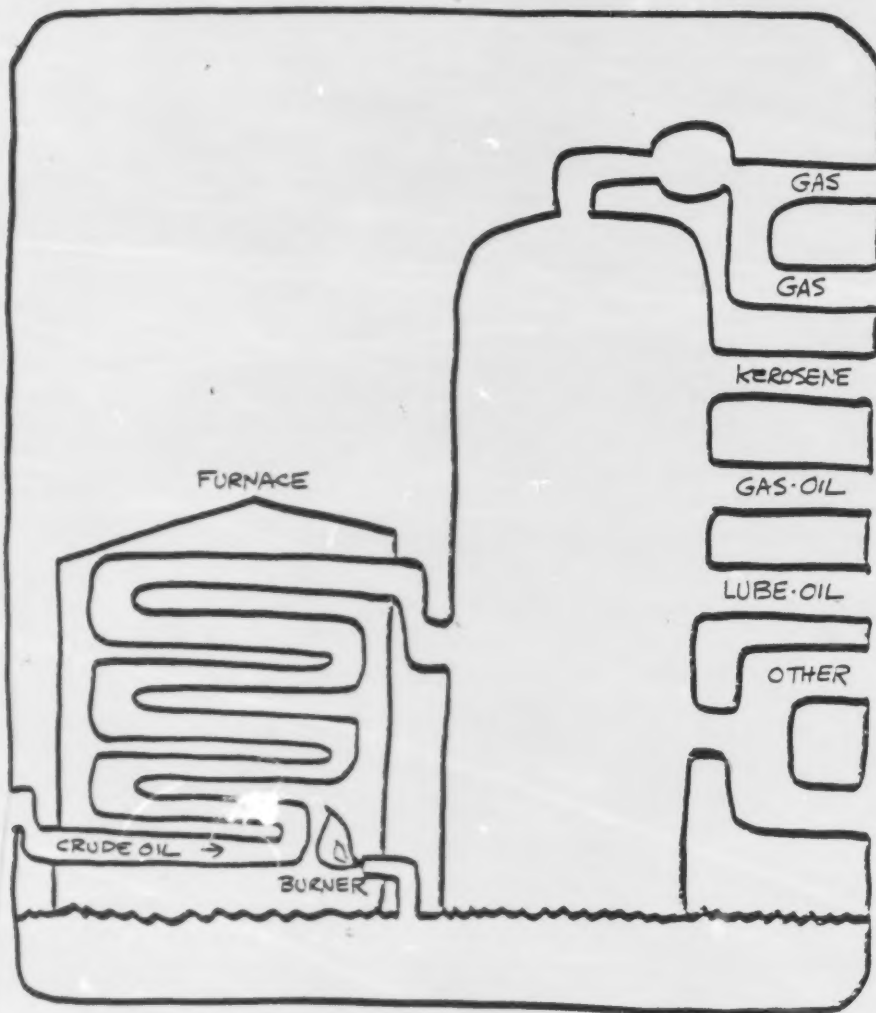
oil tanker



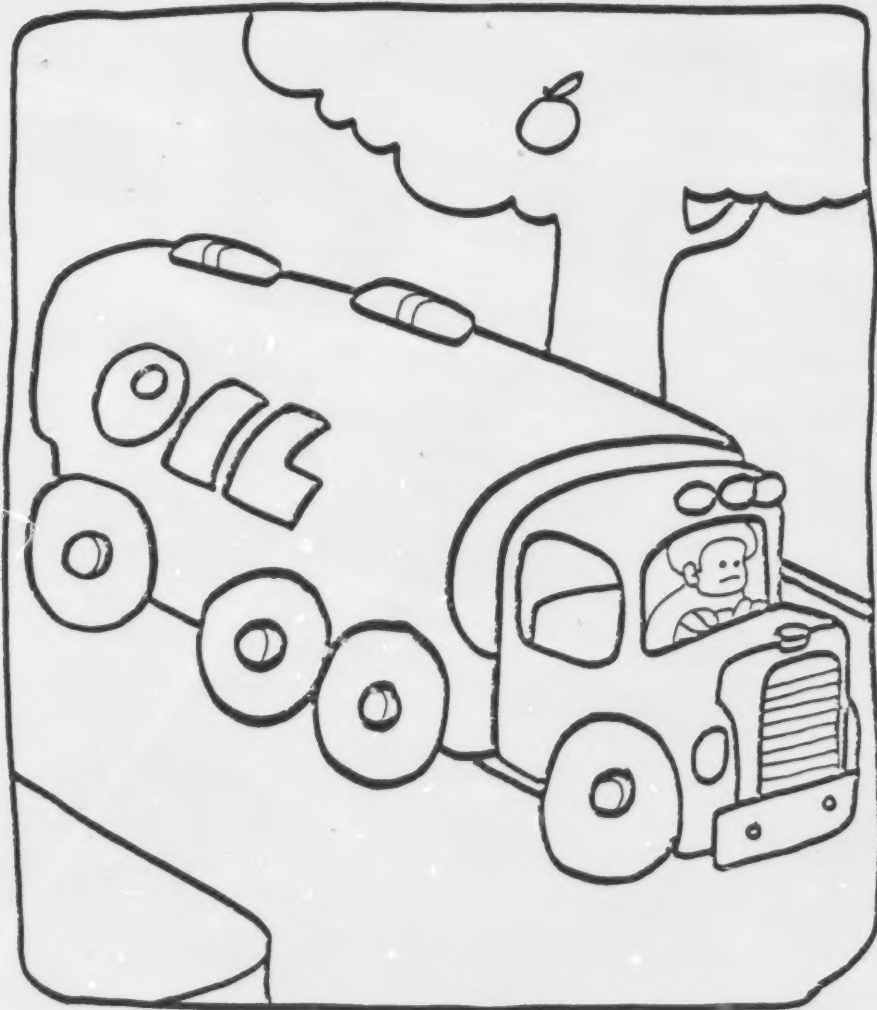
OIL SPILL



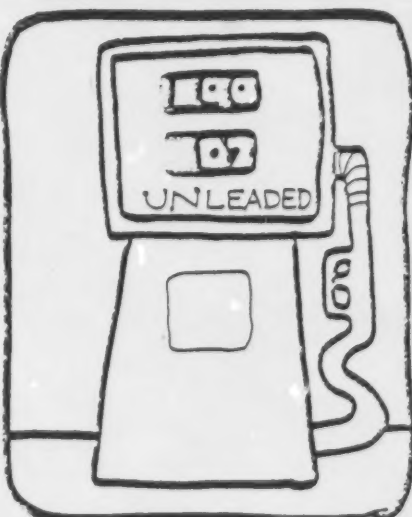
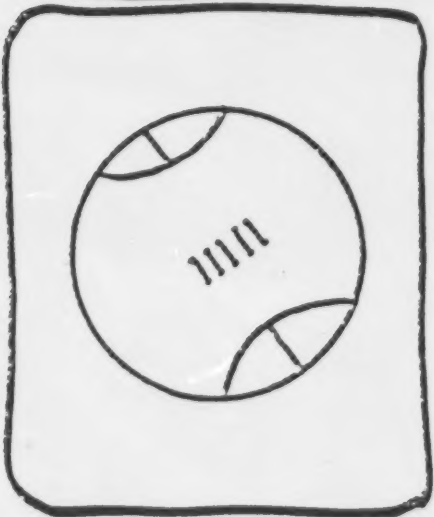
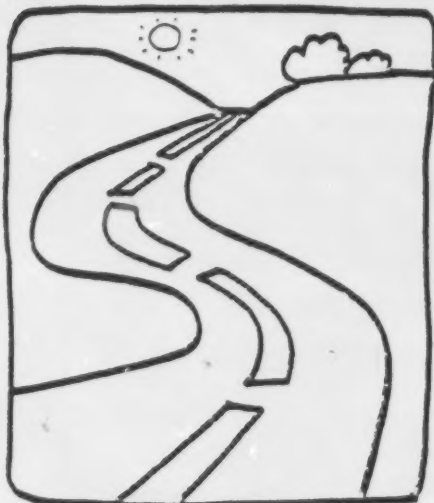
Refinery



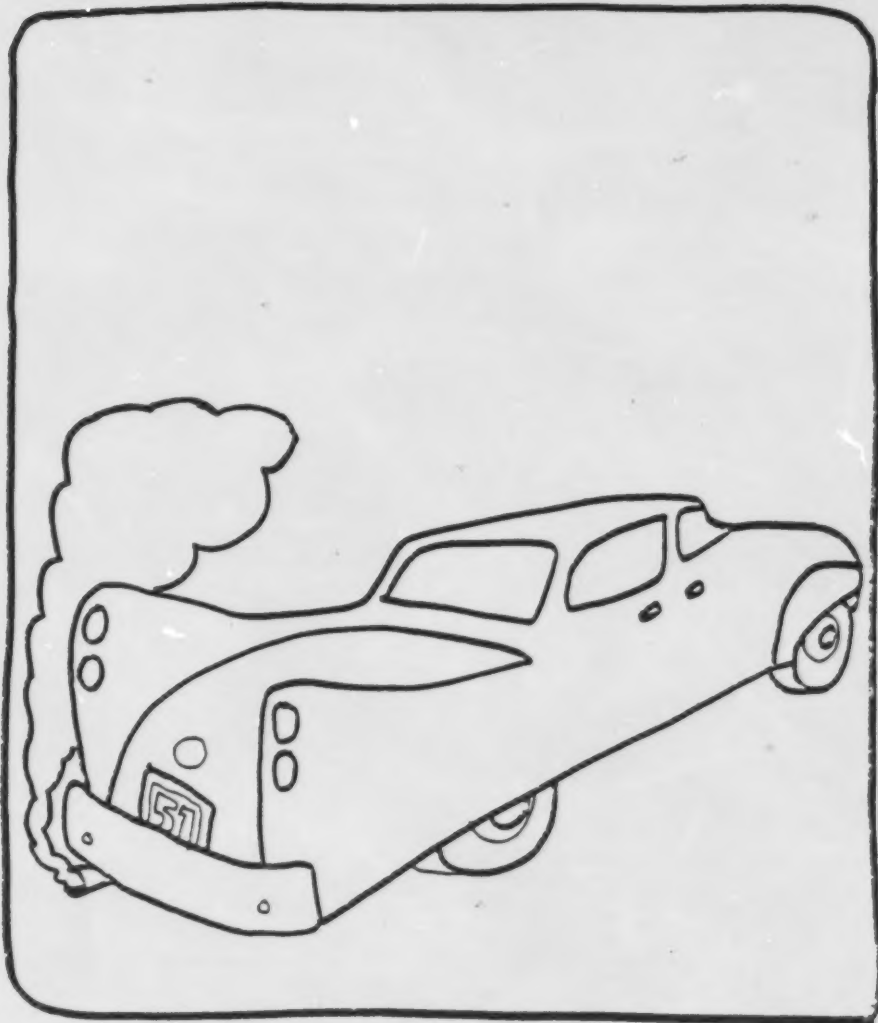
oil truck



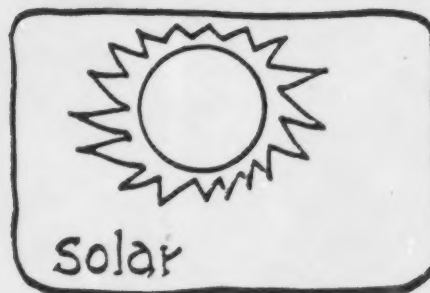
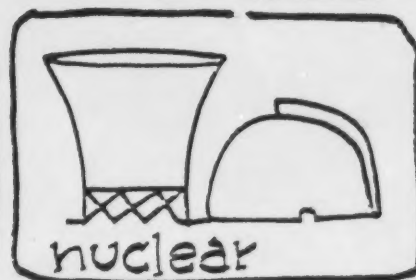
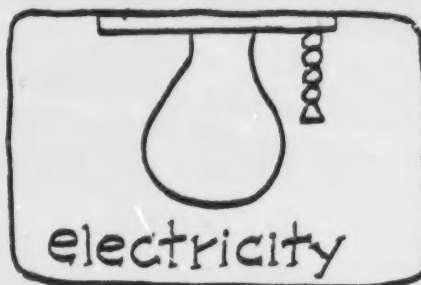
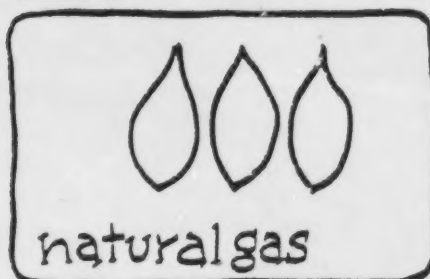
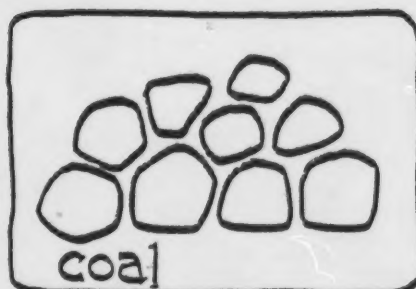
SOME OIL USES



EXHAUST



Other forms of ENERGY



ENERGY STAMPS



7



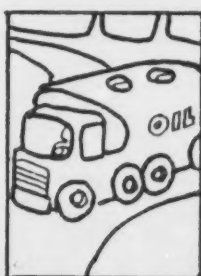
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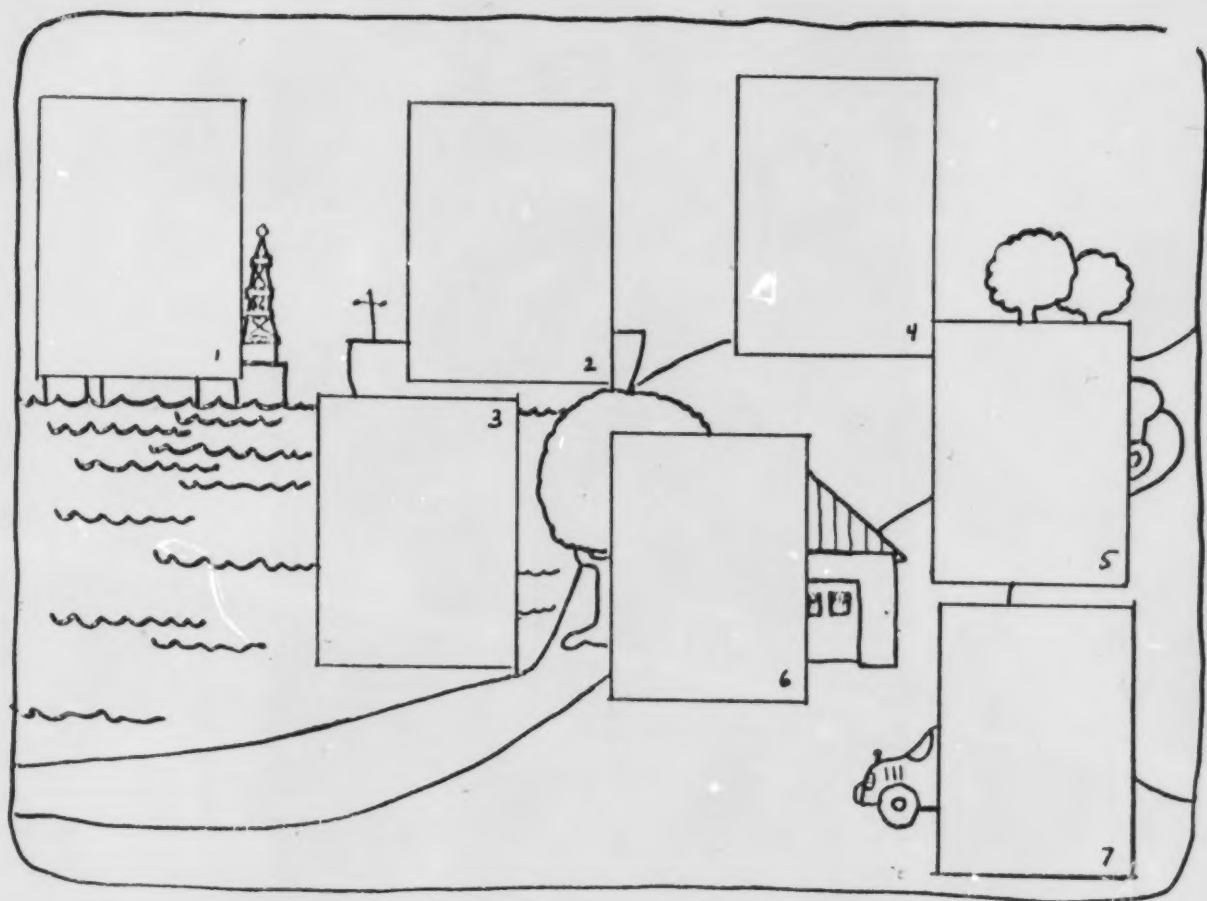


3



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oil



Grade Level 2-3

Purpose: To have students observe what coal is.

Concept: Fossil fuels provide most of the energy we use.

Materials: Energy Picture Book 5, samples of coal, Coal Energy Stamps

Activity:

1. Title Page

"What color is coal? (Black) Does anyone know where we find it?" (Underground) Obtain sample of coal for students to feel and examine.

2. First Page

Describe what is shown in the picture--mountains, trees, sun, sky, etc.

"This is a picture of a place where coal is found. We could say then that coal is found where? (In the mountains) Can it also be found in other places?" (In the Midwest plains)

3. Second Page

"What do we call a person who takes coal from the ground? (Miner) Describe how a miner is dressed--hard hat with light, work clothes, heavy shoes, face mask, etc. Tell what he does--uses drills and other equipment to dig out the coal. Why does he wear a face mask?" (To prevent breathing coal dust)

4. Third Page

"Where does a miner work? (Coal mine) How is the coal dug from the inside of the mine?" (A large mining machine with many teeth on a rotating wheel tears the coal from the mine walls)

5. Fourth Page

"Some coal that is found near the surface of the earth is obtained by strip mining. What kind of equipment is

used to mine this coal? (Huge power shovels and bulldozers. Point out the size comparison between the man and the power shovel.) To reach the coal, the earth above (overburden) is dug away and piled high in rows. Would you like to see these piles in your community? What could be done to make the land look better?"

6. Fifth Page

"How is coal moved from place to place? (Truck and railroad car) Why isn't it sent by airplane?" (Too heavy and bulky)

7. Sixth and Seventh Pages

"Where is most of the coal sent? (To power plants to produce electricity) What happens at the power plant? (Coal is burned to produce heat and the heat is used to make steam. The steam is then used to produce electricity) What is coming out of the smokestacks of the power plant? (Smoke, gases, and heat) Is it good for people to inhale smoke? Why not? (Harms the lungs) What could be done to prevent the smoke from going into the air?" (Put "catchers" in the chimney)

8. Eighth Page

"What are some of the uses made of coal? (Coal products help make paint, plastic for records and dishes, and coal is used to make heat to produce electricity) Name three things in our room that were made partly from coal." (Make display of products made with the aid of coal)

9. Ninth Page

Review vocabulary.

"Place a check by the forms of energy you have studied so far."

End this lesson by allowing students to color their favorite parts. Next day pass out Coal Energy Stamps and have students complete the picture. Again, students may add captions to pictures.

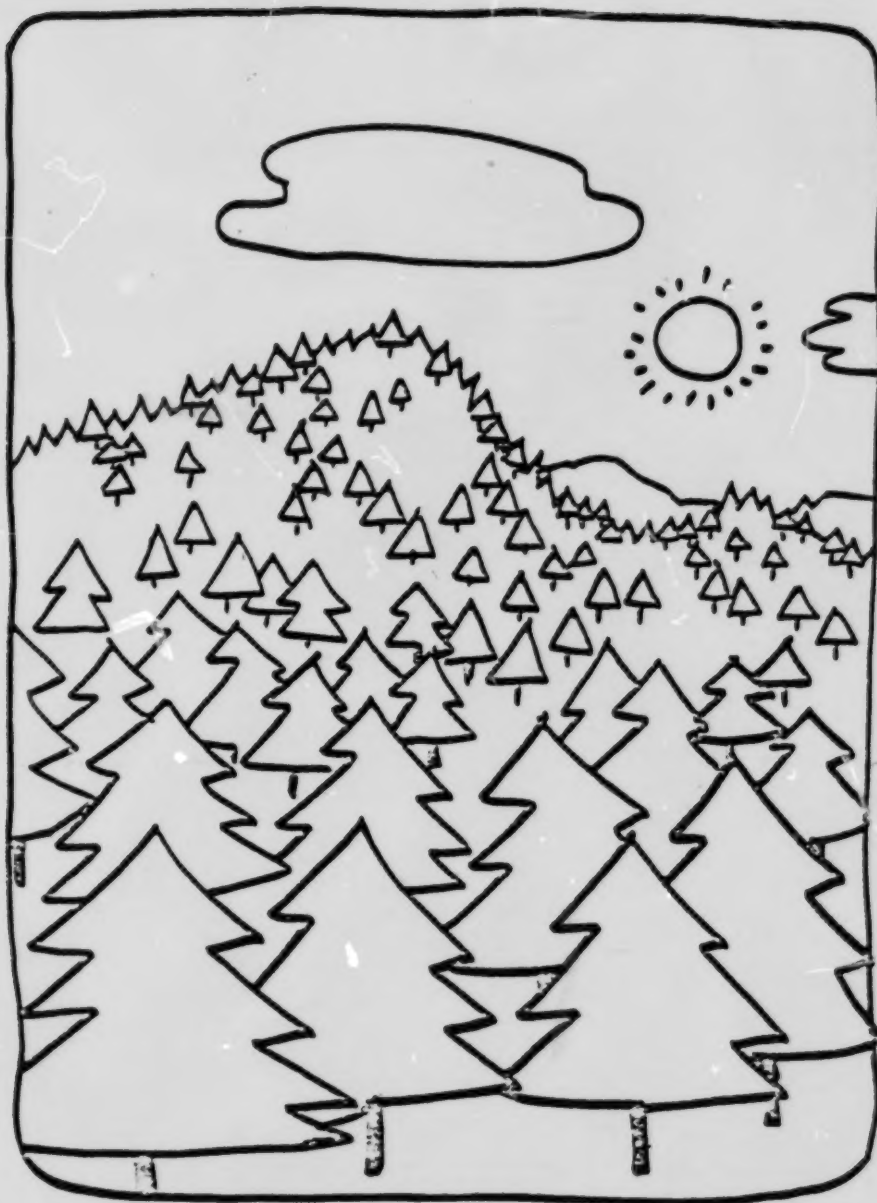
BOOK FIVE



GOAL

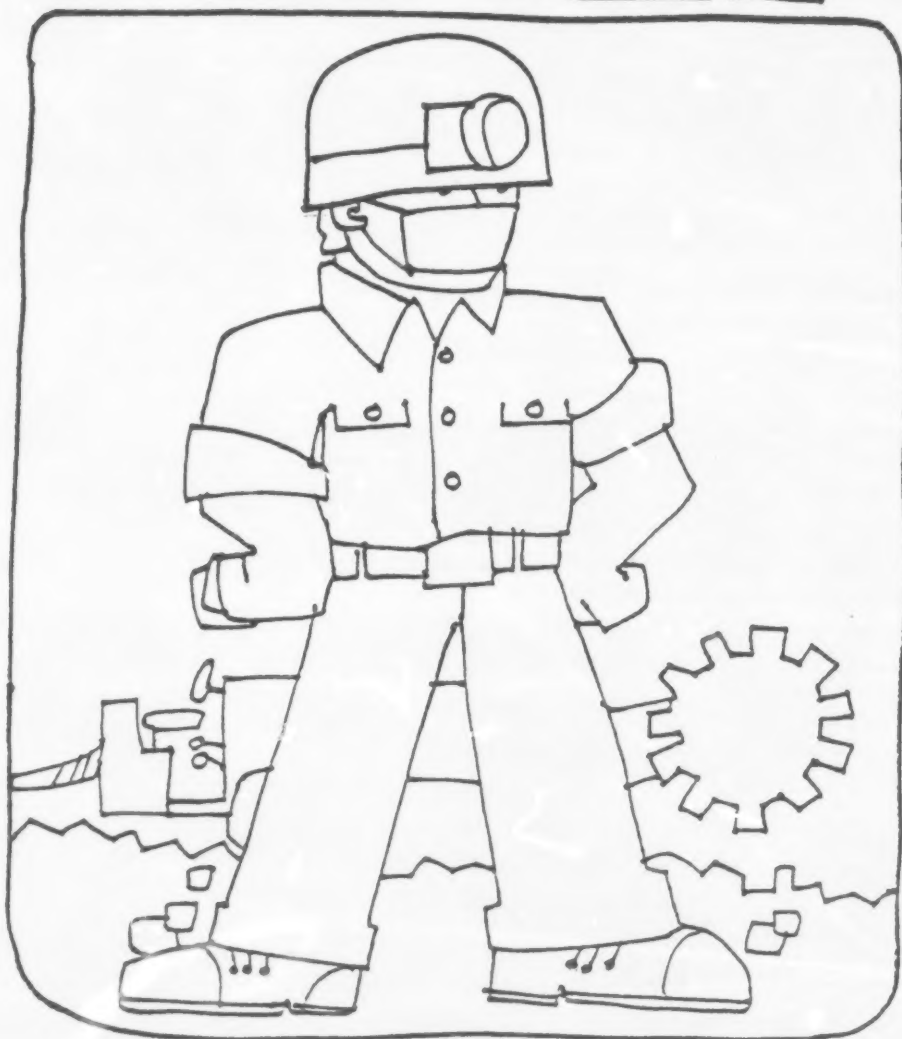
AND

ENERGY



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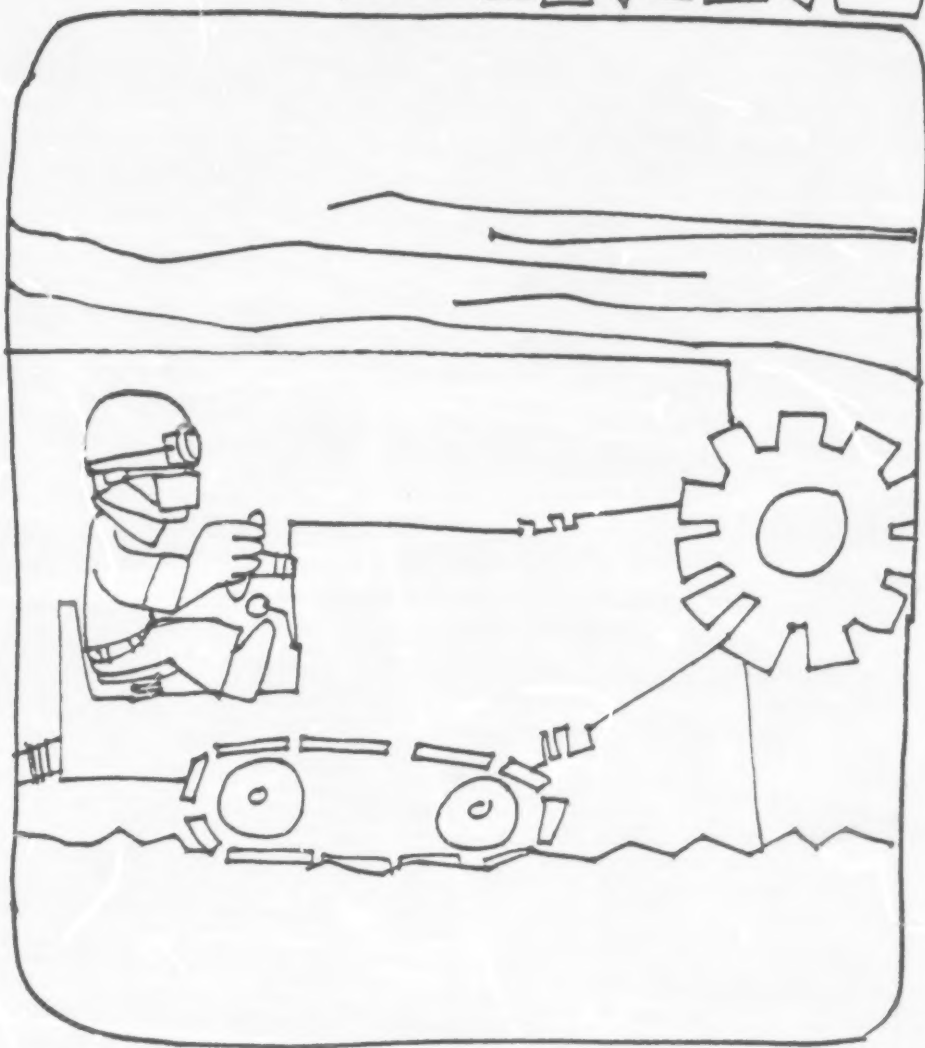
Miner



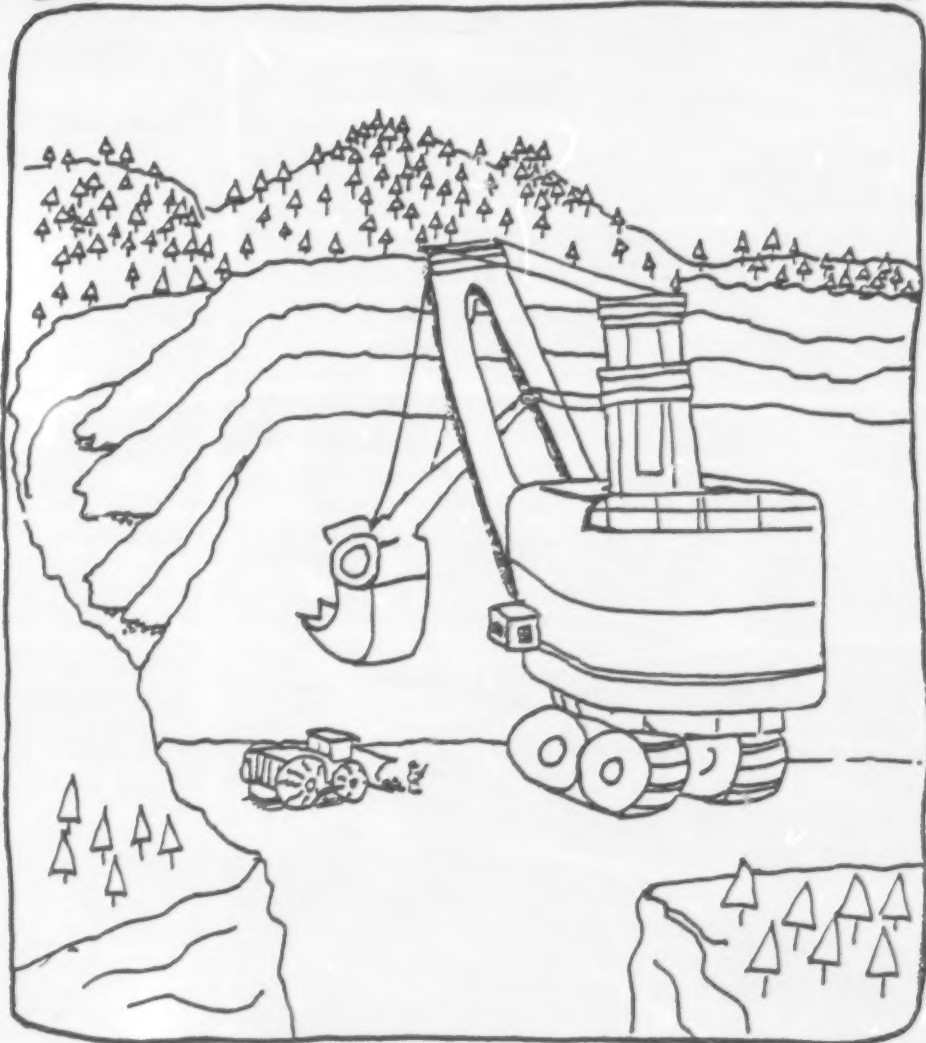
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mining machine



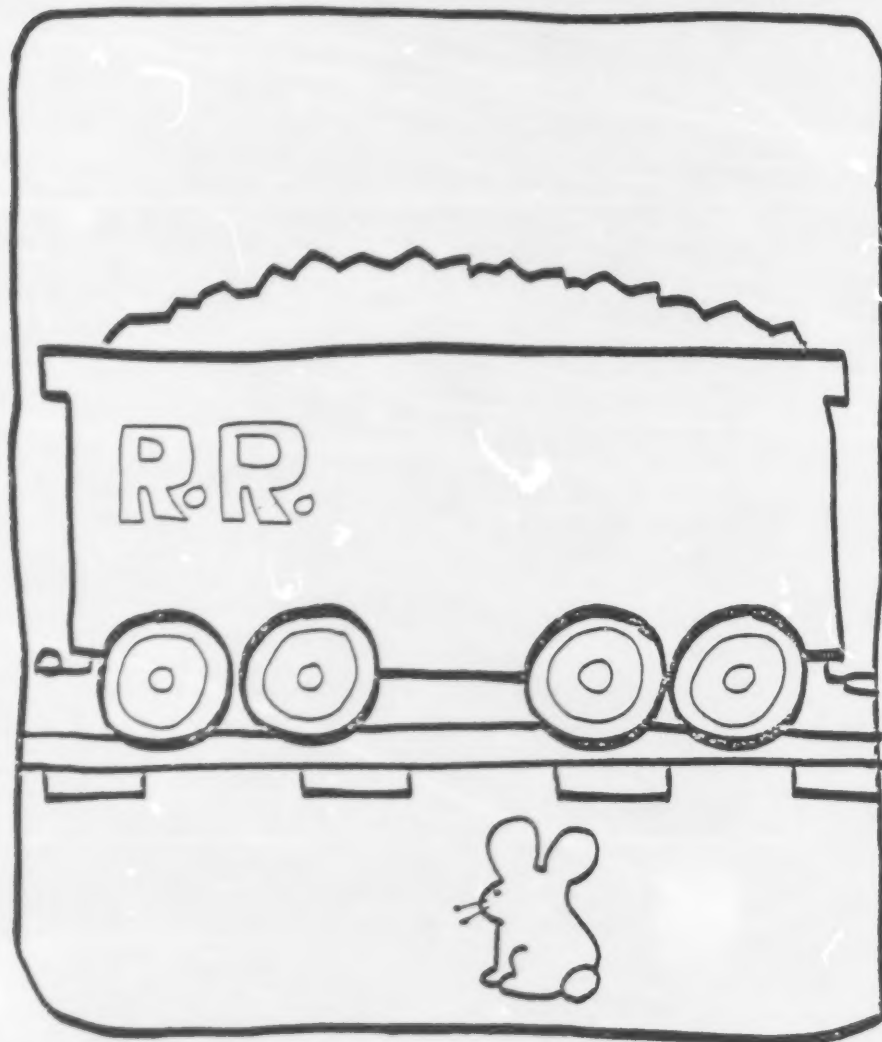
Strip mine



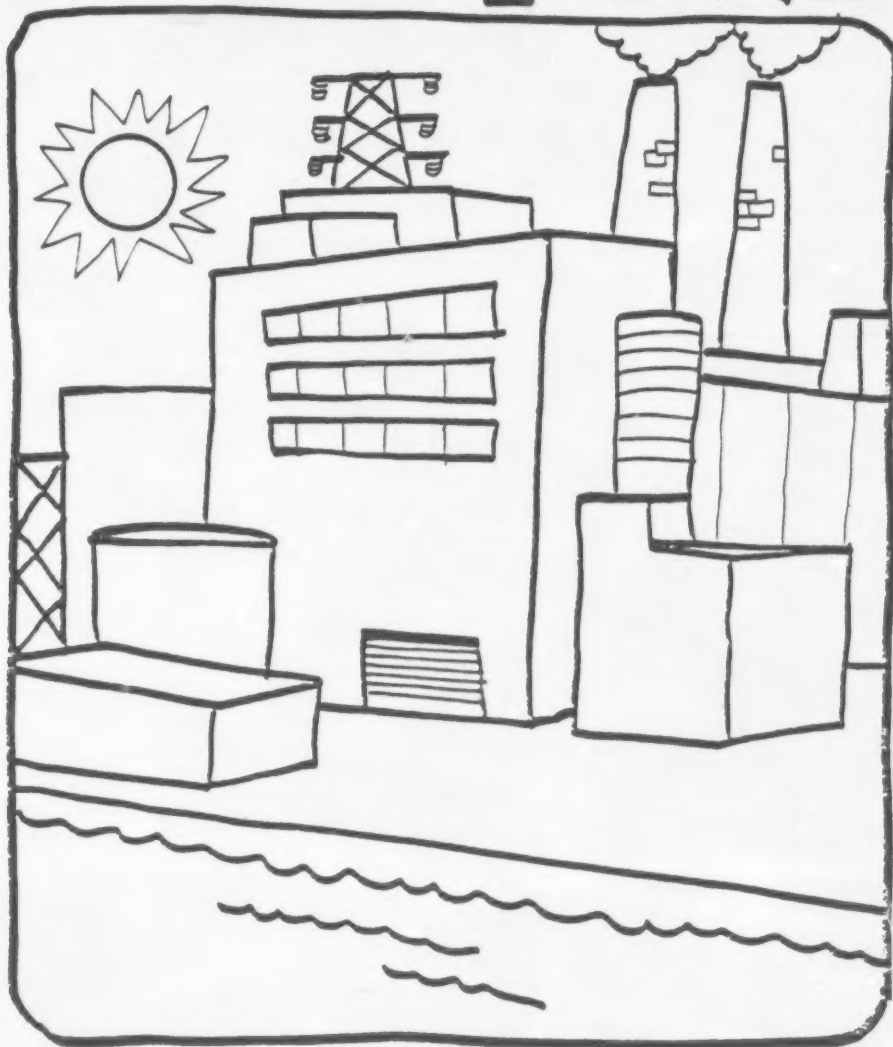
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GOAL CAR



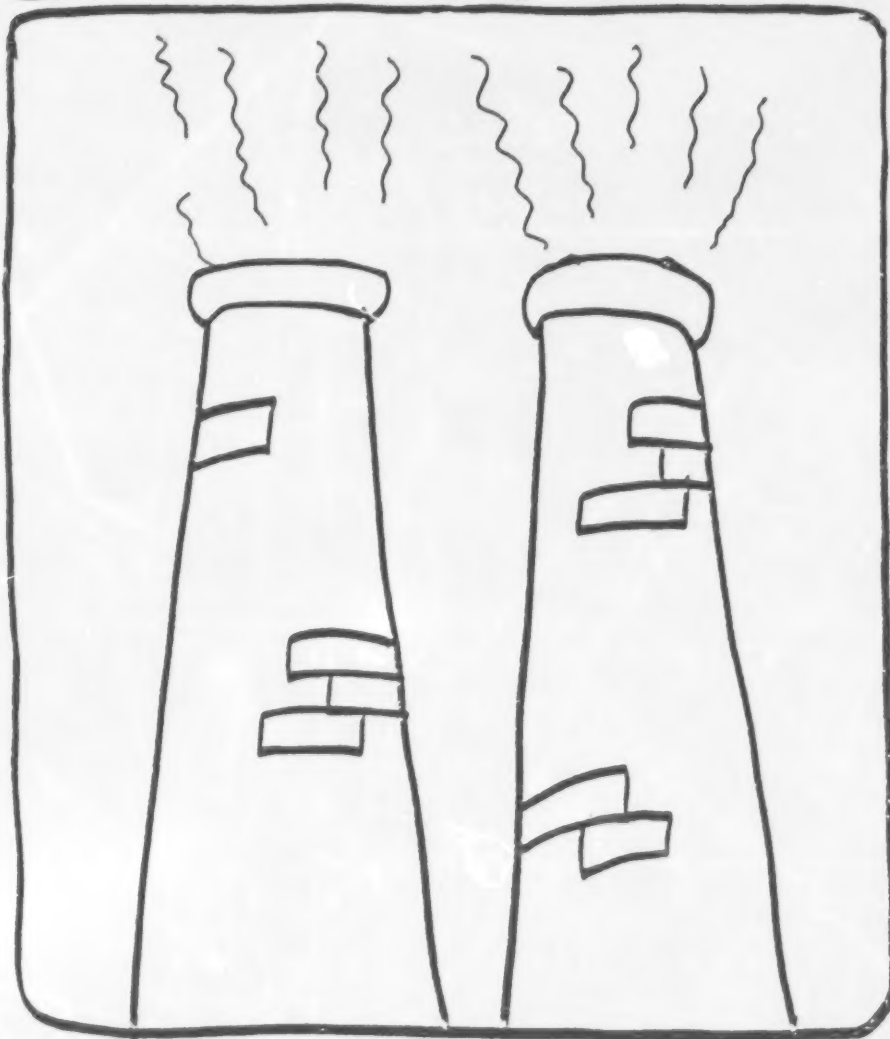
POWER PLANT



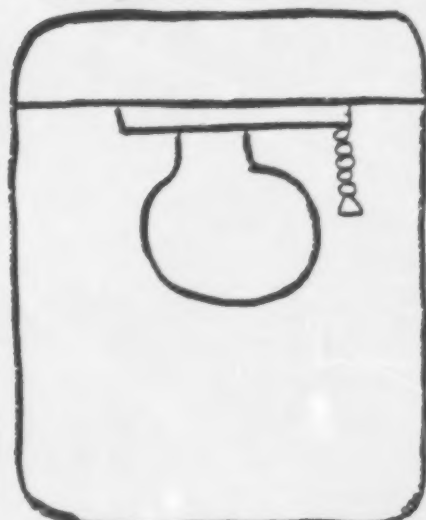
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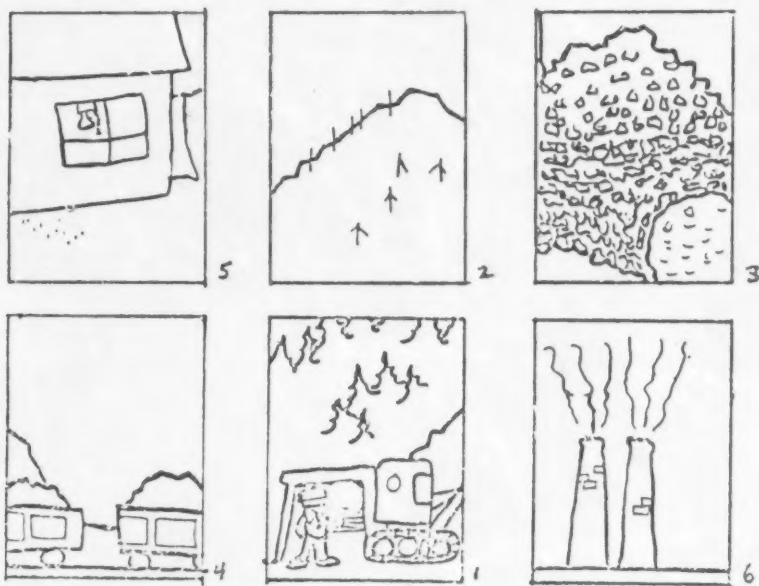
SMOKE STACKS



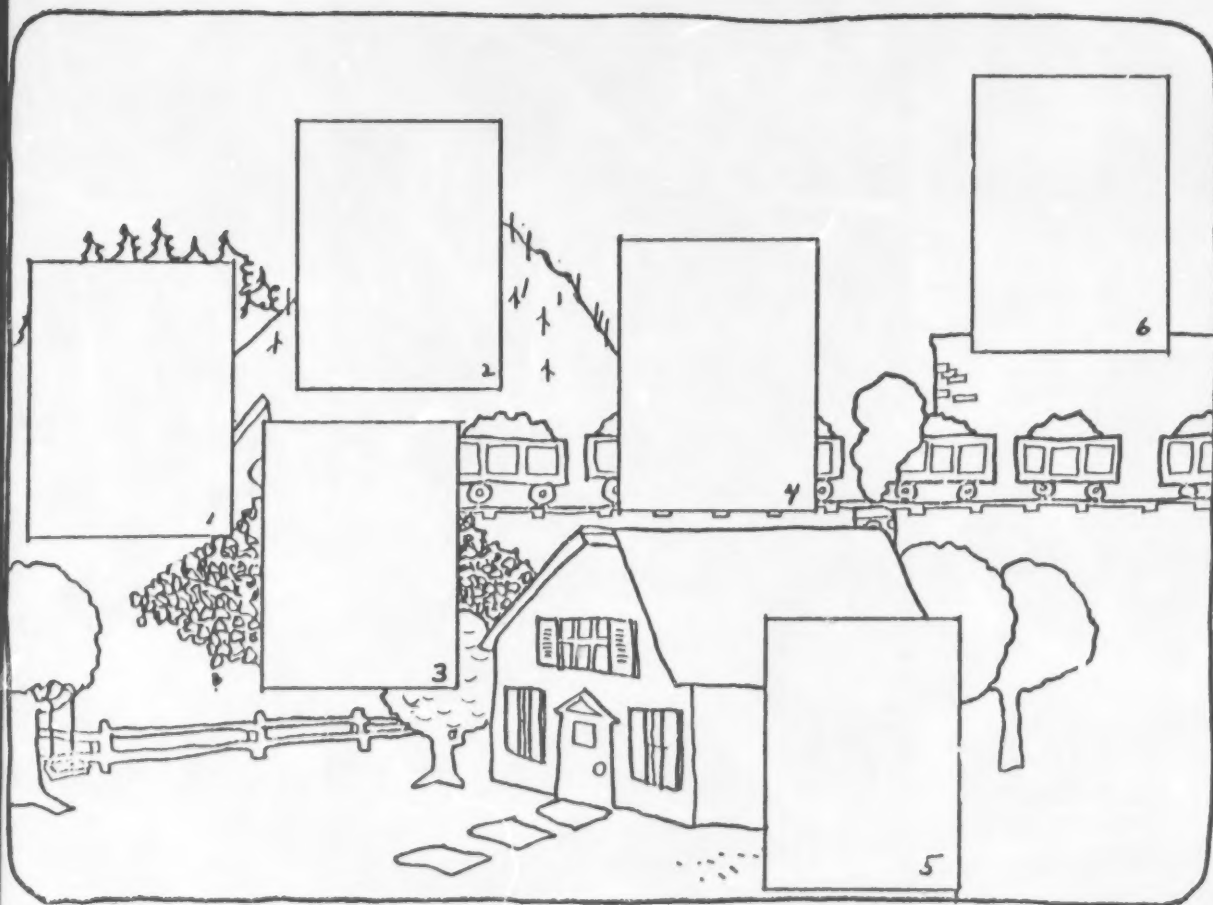
SOME COAL USES



ENERGY STAMPS



COAL



COAL

ELECTRICITY

Grade Level K-3

Purpose: To understand what electricity is.

Concept: Electricity is made from fossil fuels.

Materials: Energy Picture Book 6, Electricity Stamps

Activity:

1. Title Page

"What is electricity? (List ideas) Is it found in the ground like coal and oil?" (No--it is made from fuels like coal and oil)

2. First and Second Pages

"What is needed to create electricity? (Fuel or other source of energy) What kinds of fuels (energy) are used?" (Geyser-steam, gas and oil, water power, coal)

3. Third Page

"Where is electricity made?" (In a power plant)

4. Fourth and Fifth Pages

"Let's see how electricity is made." (Coal is burned in a furnace, heat creates steam in the boiler, the steam turns the turbine and causes it to spin, the generator changes this energy into electric energy, wires carry it to a transformer which sends it to power lines and into homes, etc.)

5. Sixth and Seventh Pages

"How can an electric power plant affect our surroundings if we're not careful?" (Add heat to rivers, which affects plant and animal life; add particles and gases to air and cause air pollution if no devices are used to clean smoke)

6. Eighth Page

"How do people use electricity?" (Neon signs to advertise, lamps, T.V., appliances, heating, etc.)

Review vocabulary. Check the forms of energy studied.

End lesson by having students color favorite parts and add section to folder.

Have students complete Electricity Energy Stamps as a follow-up activity.

BOOK SIX



ELECTRICITY

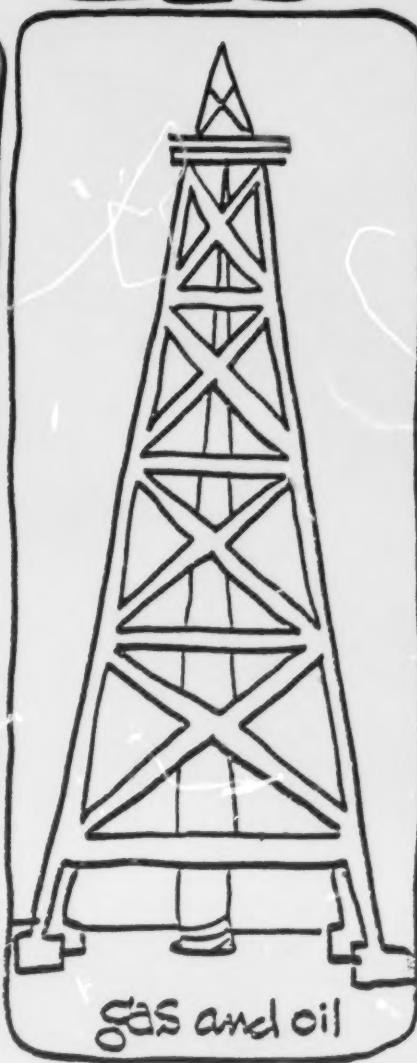
AND

ENERGY

SOURCES of

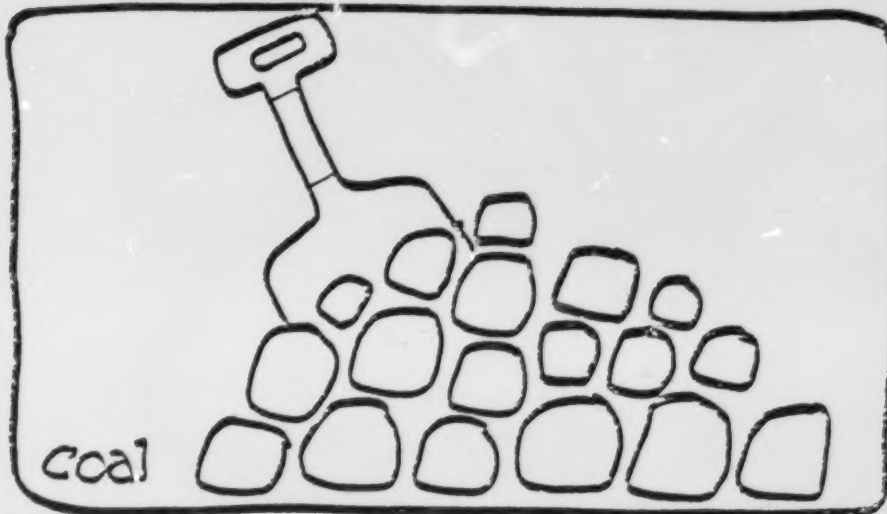
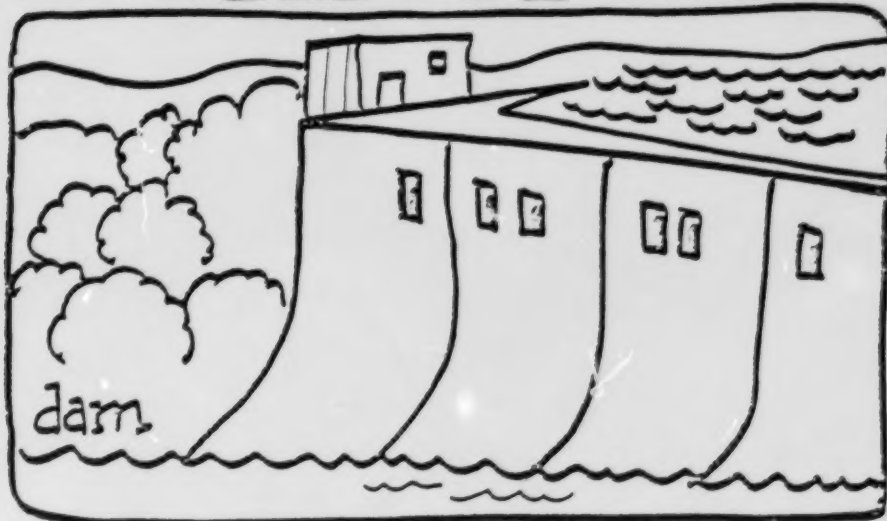


geyser

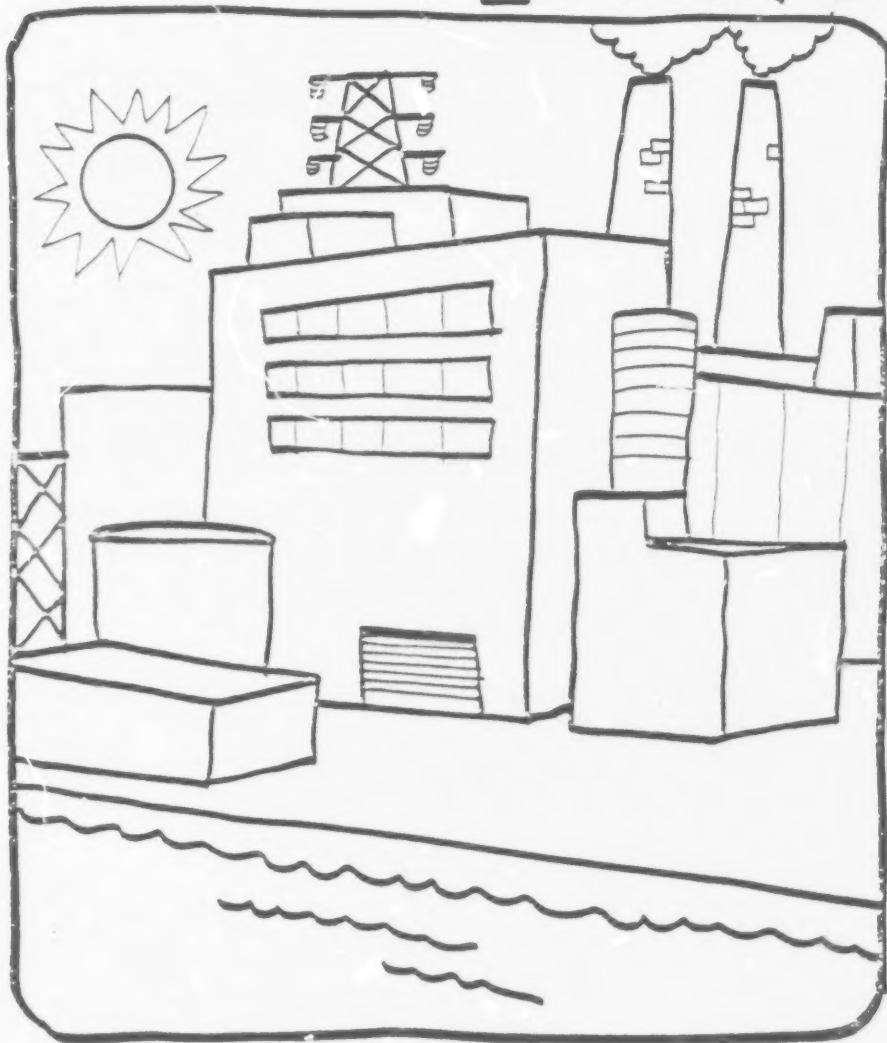


gas and oil

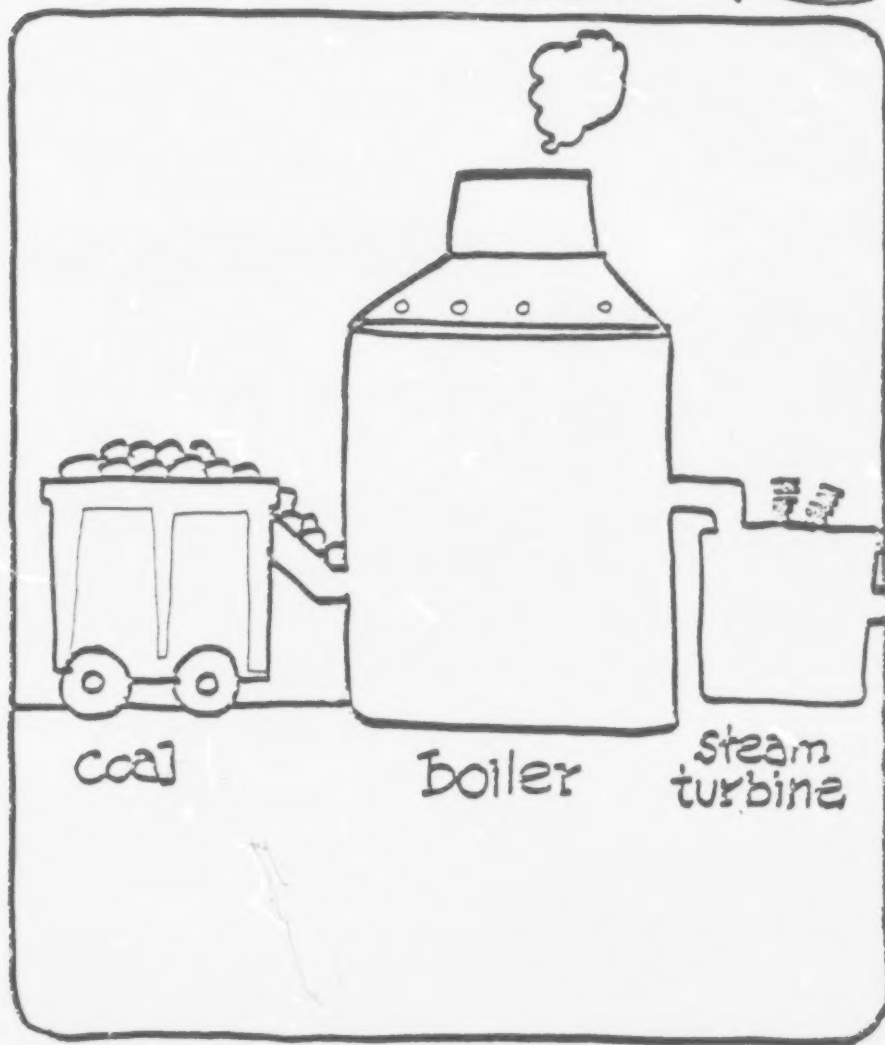
electric power



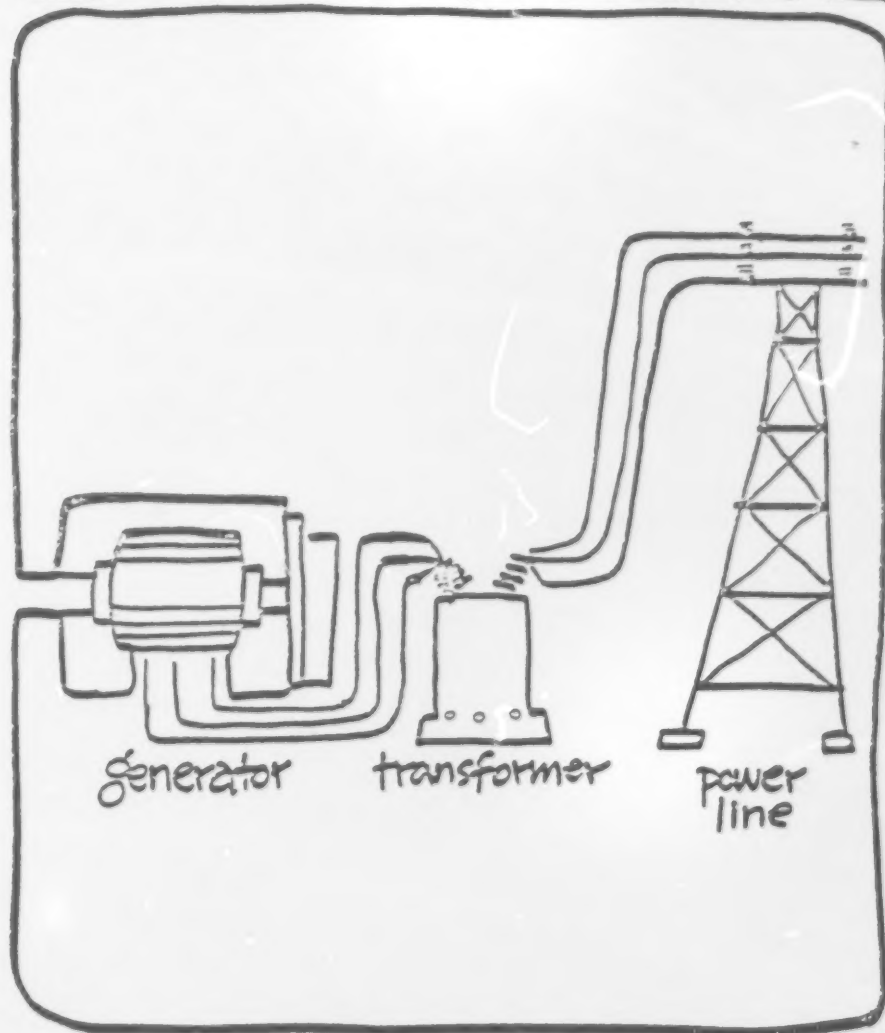
POWER plant



making



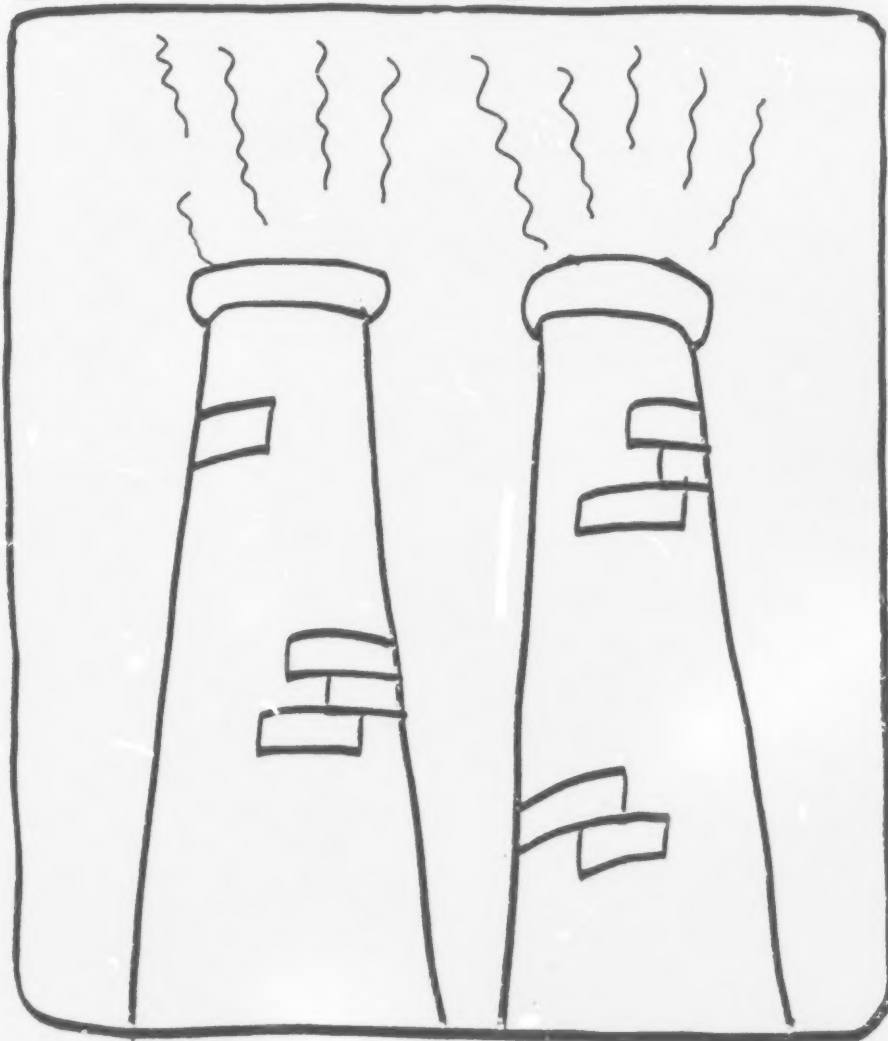
electricity



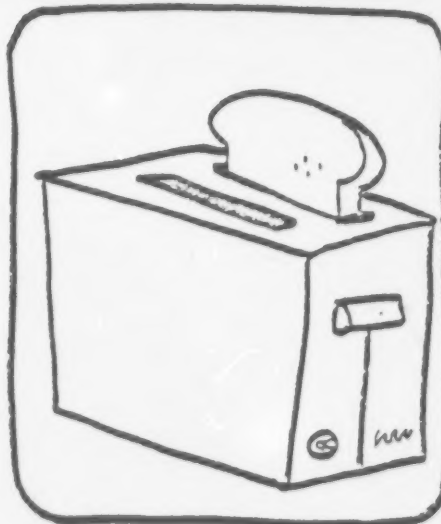
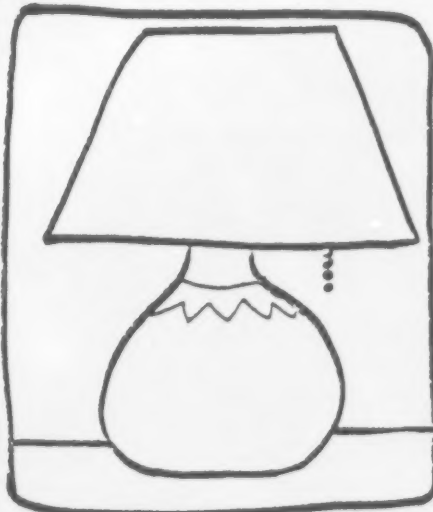
POLLUTION



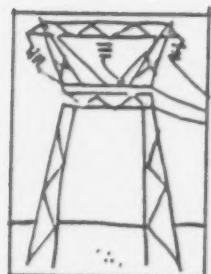
Smoke stacks



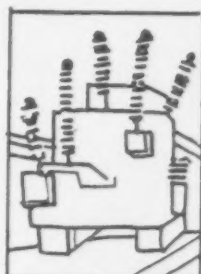
Some electricity uses



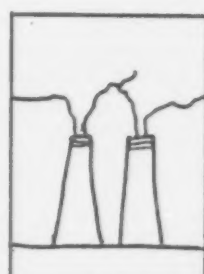
ENERGY STAMPS



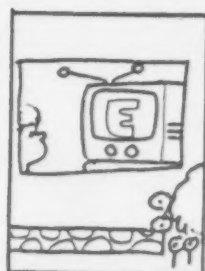
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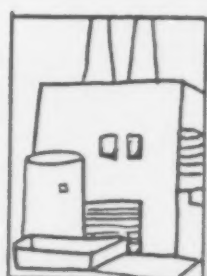
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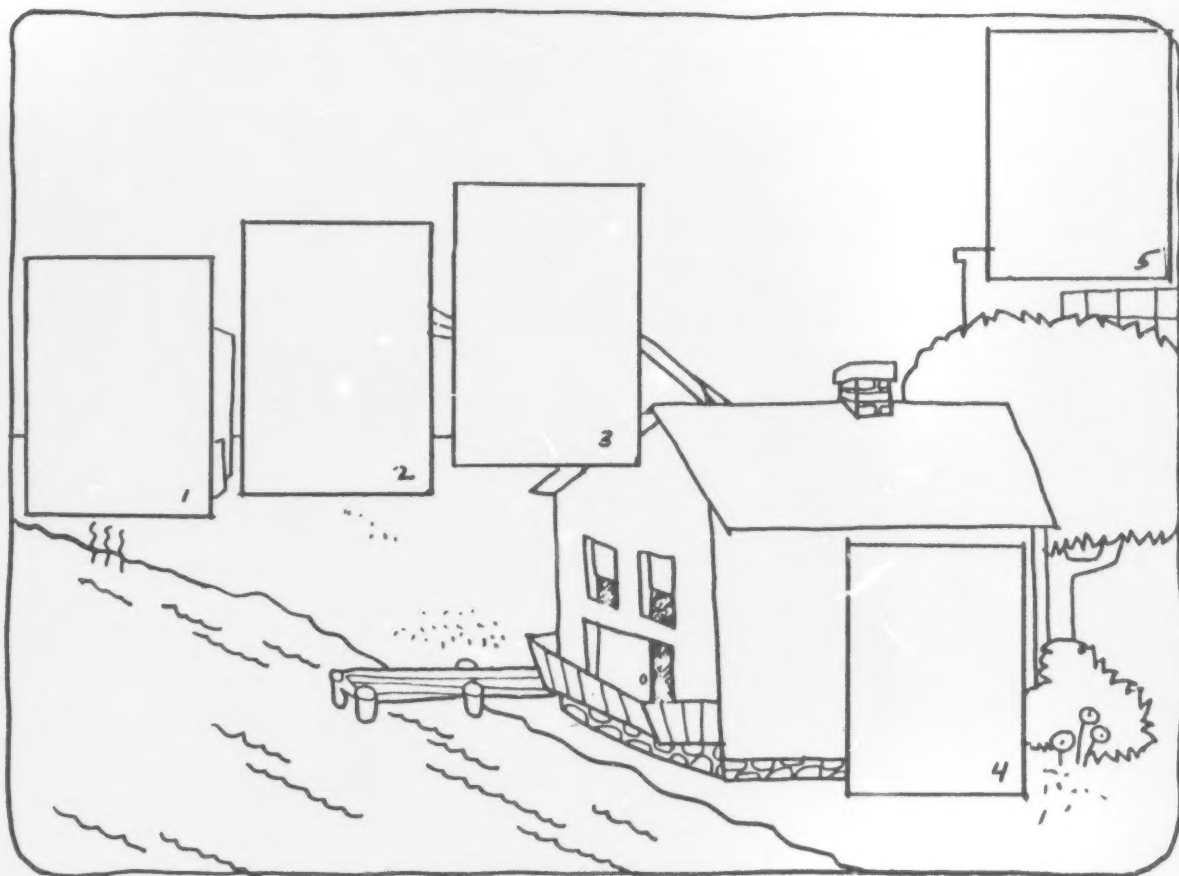


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ELECTRICITY



ELECTRICITY

PROPERTIES OF HEAT FLOW

Grade Level 3

Purpose: For the student to understand how heat can be conserved with various materials.

Concept: Heat flows from a hot to cooler environment.

Materials: 2 pots of tea and 1 lid
2 small identical beakers
2 small shoe boxes
Some type of insulation such as cotton, ceiling or roof insulation.
Thermometer

Activity:

1. Prepare 2 pots of tea (use identical pots). While the tea is still boiling hot, cover one pot with a lid. Leave the other pot uncovered. After 5 to 10 minutes use a thermometer to determine the temperature of the tea in each pot. Ask children to predict which will be warmer and why.
2. Use 2 small identical beakers and 2 shoe boxes. Insulate one of the boxes (cover box edge) as well as possible using paper, cotton, ceiling or roof insulation. Leave the other box uninsulated. Insert a thermometer in a slit in the top of each cover. Pour the same amount of boiling water into each beaker, place them in the boxes and quickly cover the boxes. Be sure that the crack around the thermometer has been well sealed, and that the lids are sealed onto the boxes. Watch the thermometer and note changes in the temperature of the water in each box. Ask children to predict what they think will happen and to explain their predictions. Discuss the results. Use the experiments as a lead-in to discuss insulation in our houses.
 - a. Which construction materials provide the best insulation? (If possible arrange for children to visit an old stone building and a newly constructed building on a hot day.)
 - b. What is thermopane? How is it used? Why is it used? Why is it not used in some houses? (It is expensive.)

- c. Is good insulation important only in the winter when fuel is being used to heat the house? Explain.
- d. What is the advantage of storm windows and doors?
- e. What kinds of materials are used for insulating houses? Prepare a display of some of the more common ones.
- f. How can room decorating (rugs, draperies, etc.) help in insulation?
- g. What steps can the average homeowner take to achieve better insulation? (Caulking of windows, storm sashes, covering air-conditioners in winter, and keeping fireplace drafts closed when not in use are examples.)
- h. If a well-insulated house saves money in fuel for heating and electricity for air-conditioning, why are more new houses not better insulated?

KEEP IT COOL

Grade Level 2-3

Purpose: To identify the direction of heat flow

Materials: ice cubes	Transparency 1 and 2 (Teacher make
Ziploc bags	transparency from original)
milk cartons	styrofoam
foil	paper
string	wood
cardboard	metal cans
	glass container

Activity: Part I: Save that Ice Cube!

By participating in a game to preserve an ice cube, students become aware of the capabilities of different materials to insulate. This lesson should be performed early in the day, since ice cubes may take about two hours to melt.

1. Introduce game and organize teams

As a suggested lead-in, tell students that you have collected some materials together for an interesting game that everyone can play. Inform them that you have a bag of ice cubes, enough to give one ice cube to every two or three students. The goal of the game is to prevent the ice cube from melting for the longest time possible--they must keep it cool!

Divide the class into groups of two or three persons. Display the materials (see materials list) that can be used by students to wrap or enclose ice cubes to preserve them. Ask each group to propose ways to do this and to perhaps write down their best idea. Encourage groups to choose different materials and means of construction, such as thickness of wrapping.

2. Proceed with game

When all groups have proposed a plan to preserve their ice cubes, let them proceed with their plans. Give each group an ice cube (they should be nearly equivalent in size) in a small plastic sandwich bag taped shut (this will keep the water from the melted cubes confined) or use Ziploc bags.

You may find students wrapping their ice cubes in paper or foil or burying them in some material where

they will not be visible. Therefore, in order to keep track of the melting process place one ice cube in a plastic bag and suspend it by a string someplace in the classroom where it will be visible to the students (not in the sunlight near a window). This ice cube will be used as a timer: when it is almost completely melted the game will end. It will take about one and three-quarters hours for a typical ice cube from a refrigerator tray to melt. However, this lesson can effectively end when all groups have finished wrapping their ice cube and the timing begins. You may want to go on to some other unrelated classroom activity during the period while the ice cubes are melting. Occasionally, have students check the ice cube that is serving as the timer to see if it is completely melted.

3. Conclude the game

When the ice cube suspended in the plastic bag is melted or nearly melted, have students obtain the ice cube bags from their environments and compare the results. Identify with students the materials which preserved the ice cube the longest. Did the thickness of the material make any difference? Ask them to think about what materials they would use if they played the game again.

Ask students to save milk cartons for Part 3.

Part II: Insulation and Heat Flow

Students develop concepts of insulation and heat energy transfer (or heat flow) through classroom discussion.

1. lead students to the concept of heat energy transfer.

Review results of game. How long did it take for the unwrapped ice cube to melt? Were any ice cubes still unmelted? Which materials preserved the ice cube the most at the end of the game and what materials were used to preserve it?

Ask students: "Why did the ice cubes melt?"

Provide clues to answer: "Would you say the ice cube is cold? Is the room warmer than the ice cube?"

Inform students that one of the laws of nature is that warm things have more heat energy than cold things, and when a warm thing is placed near or around a cold thing, some of that heat energy is transferred or flows to the cold thing. By wrapping

or enclosing the ice cube, students were slowing down the transfer of some of the heat energy in the room to the ice cube. The results of the game indicate that some materials can slow down the transfer of heat energy more than others.

2. Develop with students a definition of insulator.

Ask: "Which materials did we find slowed down the transfer of the heat toward the ice cube more than others? Can we give these materials a name that tells us they are good materials to slow down the motion of heat? Let's call them insulation materials or insulators."

Discuss with students what materials might be called good insulators and what materials might be called poor insulators. Have students classify materials they used in game as good or poor insulators based on the results of their game.

3. Generalize experience by providing other examples of heat energy transfer and insulation.

Discuss with students several examples in which insulation is used to keep things cold; for example, ask students:

- a) "Can you think of other situations where we try to keep things cold by using insulation? How about a refrigerator? Where is it cold? Where is it warm?" (Draw a sketch or display a picture of a refrigerator.) "Which area has more heat energy? Which has less? How is the transfer of the heat slowed down?"
- b) "Suppose you bought some ice cream at the supermarket to take home. Is the ice cream put in a special bag to prevent it from melting? Where is it warm, where is it cold? What kinds of materials are used to slow down the transfer of the heat energy to the cold area?"

Discuss with students several examples in which insulation is used to keep things warm; for example:

Ask students:

- a) "Do you wear heavier clothes (coats, etc.) in the winter than you do in the summer? Why? Is it colder? What kinds of clothes does an Eskimo wear? A Hawaiian? Could we call the clothes an

Eskimo wears insulators? Which area has more heat energy? Which less energy? Can clothes slow down the transfer of heat energy from one area to another?"

- b) "Are there other examples you can think of where we use insulation to keep things warm? That is, examples where we slow down the transfer of heat and try to prevent it from leaving something so it will stay hot? How about coffee cups? How are they made? Are good or poor insulators used?"

4. Relate discussion to home insulation in preparation for next lesson.

Ask students:

"Are the walls and ceilings of our houses or apartments insulators? Why? What happens in winter? Where is it cold? Where is it warm? In what direction is the heat transferred?" (Inside to outside) "Is it slowed down in any way?"

"What happens in summer? Suppose you have an air-conditioner. Where is it cool? Where is it hot?" (Cool is inside, hot outside) "In what direction is heat transferred?" (Outside to inside) "Is it slowed down in any way?"

As an assignment, ask students to investigate at home the kinds of materials that are used to keep things cold or hot. Perhaps they can arrange with their parents to view some area in their house or building where the insulation is exposed, such as in an attic. What kinds of materials are sold in hardware stores and lumber yards to insulate homes?

Request that students think about now they would insulate a house--what materials they would use and where they would put them, and how these would slow down the transfer of the heat energy.

Remind students to bring in milk cartons for tomorrow's lesson.

Part III: Insulation and Homes

The relationship between the increased use of insulation in homes and the decreased use of electricity and the cost for cooling and heating homes is developed.

Special preparation: Collect milk cartons

1. Review assignments with students. Discuss with students their examples of situations where insulators are used to keep something hot or cold, and of how their homes are insulated.
2. Organize and proceed with second "Keep It Cool!" game with model houses.

Conduct same type of game as in first lesson, except this time have students construct small model houses using pint or one-half pint milk or cream containers (see drawing on page 179). Have students "insulate" house by wrapping or gluing different materials on outside of container. Have students place ice cube in plastic bag inside container. Time game as before with a separate ice cube which is uninsulated.

3. After game has started, discuss with students the role of an air conditioner.

"How many students have an air conditioner in their homes? Have you been in stores or other places with air conditioners? Is it colder inside or outside?" Ask students if they know what powers most air-conditioners.

"What would happen if they were unplugged? What do the air conditioners obtain through the wires from the plug to the unit?"

Bring out the point that most air conditioners run on electricity. "What would happen if there was a power failure and they didn't work? Would the rooms warm up and 'melt?' Could the air be kept cold for a longer period of time if there were more insulation? Would it be as necessary to run the air conditioner for as long a time if a house or store had more insulation? If we use an air conditioner less, is less electricity used?"

4. Compare insulated and uninsulated homes.

Show Transparency 1 and ask students to describe the differences between the two homes in the summer. Which one has more insulation? Which one is cooler? Hotter? Which one is using more electricity?

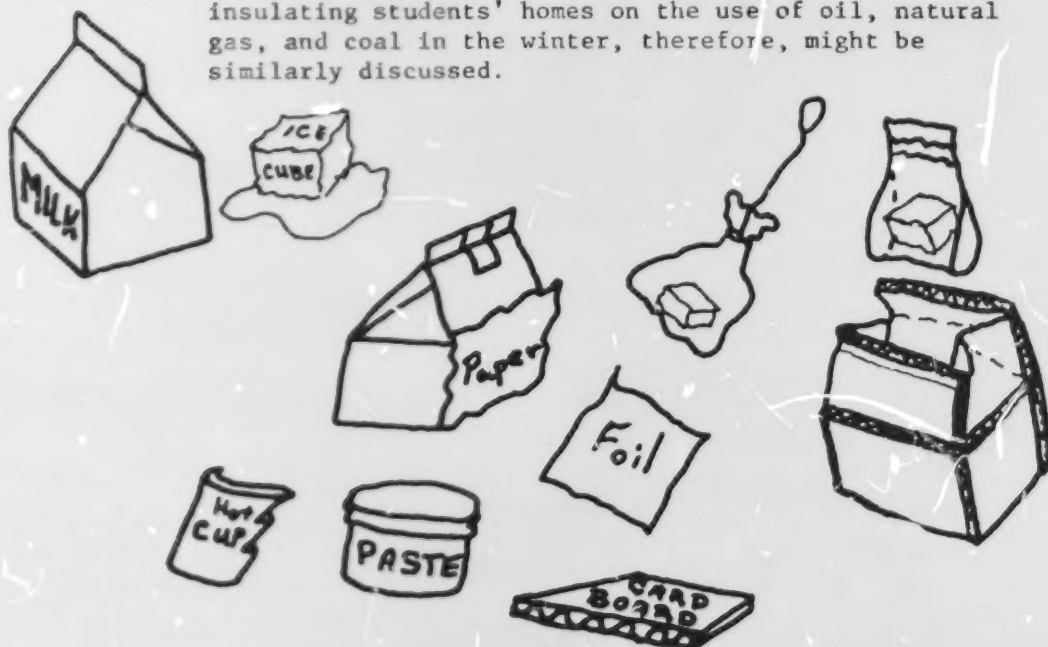
Tell students that we must pay for the electricity we use, usually each month, when the bill from the electric power company comes in the mail. Ask them:

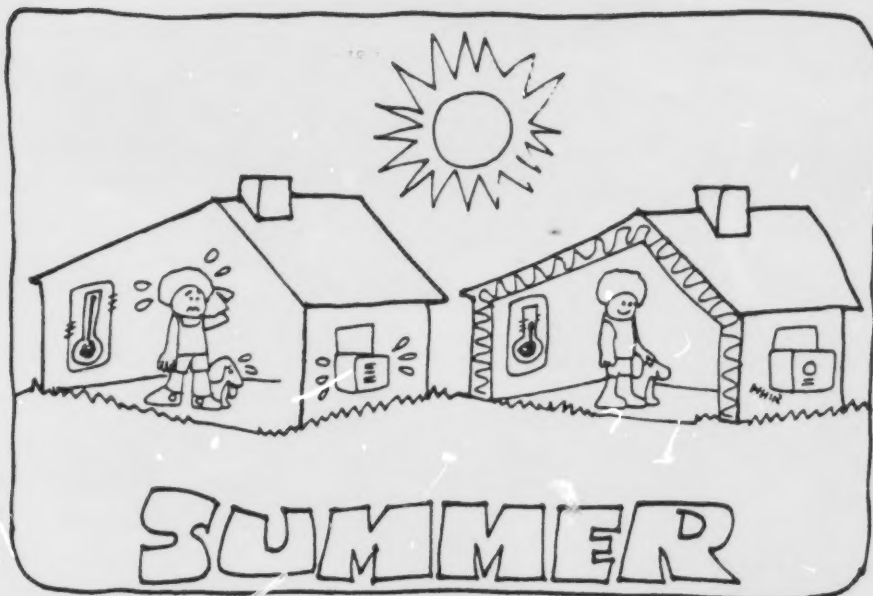
"Which house used more electricity and thus would cost more to keep cool with air conditioning?"

Inform them that in an average size house each year they could save \$35 to \$60 or more if the house had adequate insulation in the ceiling and walls.

Ask students to describe the differences between the two homes shown in Transparency 2 in the winter. Which one has more insulation? Which is warmer? Colder? Which one would use more electricity or some other fuel to keep the house warm? Inform students that each year a family could save \$425 to \$712 by having an insulated house compared to an un-insulated house.

5. Have students choose their preferred home. Conclude discussion by asking students to choose the home they would rather live in and to describe their reasons. Proceed to other classroom activities if ice cubes still have not melted.
6. Conclude mini-unit at conclusion of game. When un-insulated ice cube has melted, have students remove their ice cubes from their model houses. Determine which houses preserved the ice cubes the best. Discuss the results with students.
7. (Optional) Electricity is the major energy source for home air conditioning; however, it is not the major energy source for home heating. The effect of insulating students' homes on the use of oil, natural gas, and coal in the winter, therefore, might be similarly discussed.





Transparency 1



Transparency 2

FOSSILS

Grade Level K-2

Purpose: To help children learn about the major sources of energy which we use.

Concept: Oil is a non-renewable source of energy.

Materials: Samples of oil and coal
Fossils
Plaster of Paris or clay
Straws

Activity:

1. Examine samples of oil and clay.
2. Make a display of samples of fossil fuels and label them.
3. Examine a fossil, explore the meaning of the word fossil, and discuss the ways and the amount of time it takes fossil fuels to be formed.
4. Make leaf prints in plaster of Paris or clay to develop the understanding of fossils.
5. Build oil derricks with straws.
6. Take a field trip to an oil field or coal mine.

Discuss with students how fossil fuels are formed, time required, finiteness of supply, current rate of use, etc., to help them understand why we will run short of fossil fuels.

Energy: A Teacher's Introduction to Energy and Energy Conservation, Ohio Department of Education, Columbus, Ohio, 1975.

FINITE SOURCES OF ENERGY

Grade Level K-2

Purpose: To help the children become aware of the fact that the energy sources we use today will not last forever. When they grow up, there may not be enough of these sources of energy.

Concept: Energy, it's production, use, and conservation are essential in the maintenance of our society as we know it.

Materials: Crayons, six boxes

Activity:

The teacher brings to class a half dozen new boxes of crayons. The children count them. The teacher states these are all there are. Two children are invited to come take crayon boxes. The teacher asks if there are enough left. Three more children are invited to take crayon boxes. The children are asked about what is happening to the supply and are reminded that there are no more. With one box remaining, all of the children are invited to come get crayons. The teacher asks why all the children cannot have crayons. The children are led to realize that: (1) there are no more; (2) that larger numbers of children need the smaller amount of boxes; (3) that great care should be taken of the crayons which they have; and (4) that the crayons will need to be shared. Discuss the meaning of the word "non-renewable". Recall the fossil fuels (coal, oil, natural gas) and emphasize that they are non-renewable. They can be used up. Have children assume that there is no more electricity and describe all of the things they could not do or have if there were no electricity. They might draw pictures of the things they would miss the most.

PINWHEELS

Grade Level K-3

Purpose: To observe energy of moving air.

Concept: Energy is so basic that nothing moves or is accomplished without it.

Materials: Paper
Straight pin
Pencil with eraser

Activity:

Have students construct simple paper pinwheel. Allow students to play with the pinwheel (example: blowing at it, running with it, or placing it in front of a fan). Guide them to observe that the faster the air moves, the faster the pinwheel turns; thus more energy is present. Also, help them observe that the pinwheel turns faster when facing directly into the force of the moving air.

ABSORPTION

Grade Level K-3

Purpose: To demonstrate the heating effect of sunlight.

Concept: There are alternative sources of energy such as solar energy.

Materials: 2 pans or bottles
2 thermometers
Water

Activity:

Students can use a pan or bottle for this exercise. Each student group will need two identical containers and two thermometers. Since most of the students at this level cannot read a thermometer, they can use uncalibrated ones and using a grease pencil, mark the initial and final readings. Interpretation can be based upon a change or rise in the column. Students will put one container in sunlight and another, filled with the same quantity of water, in the shade. Initial temperature readings should be taken. After one hour students should check their containers and make a final temperature reading. Discuss with the students what has happened. How can you tell? Has the temperature increased, decreased, or stayed the same? Did the sunlight have any effect on the water temperature? Did the shade have any effect on the water temperature? Optional: Students can paint their containers with non-water soluble flat black paint and repeat the exercise. Did the black paint have any effect on the water temperature? Discuss the use of solar energy to heat homes.

SOLID WASTE AND ENERGY

Grade Level K-3

Purpose: To enable students to identify alternate energy sources.

Concept: Energy can be converted to other forms.

Materials: Assorted trash

Activity:

At the end of the day have children pick up any paper and other litter they have dropped on the floor or thrown into their desks. Place all this material in a pile on a piece of newspaper or in a box. Then empty the wastebasket into another pile. Ask the class what state of matter these items represent. Write "solid" on the chalkboard. Add the word waste. Discuss the meaning of the word waste and the meaning of the new expression, "solid waste". Indicate that although our society has environmental problems related to gaseous and liquid waste, it is the collection of solids which we throw away that is becoming one of our most serious problems. Show that the contents of both piles of "solid waste" are quite similar and the only difference is that the wastebasket is a tidier way of disposing of classroom waste than littering. Stress that an object thrown into a wastebasket is as much a "waste" as one thrown on the floor. Taking appropriate sanitary precautions, have the children sort through the "solid waste" accumulated by the class in one day, and discuss the following questions:

1. What type of material is found in the greatest quantity in this accumulation?
2. Which items could be salvaged? (Large pieces of paper with little written on them, rubber bands, crayons, pencils, and paper clips are examples.)
3. What does this tell the children about our habits of discarding things?
4. How can some of the wasted items be re-used? (Memo pads from discarded paper, milk container planters and writing on both sides of the paper are examples.)

Living Within Our Means: Energy and Scarcity, Environmental Education Instructional Activities, K-6, Yorktown Heights, New York.

5. Which things could be recycled? What does recycling mean? Are there recycling centers in town? Can the school set up a newspaper collection center for recycling? How is recycled paper used?
6. How does solid waste create problems? How does your community dispose of solid waste?
7. Do we need all the things we use? Is there any danger that some of the solids we are using might some day be used up? (aluminum, copper, paper)
8. Why do Americans use and waste so many things?
9. How do we compare with other nations in this regard?

CONVERSION OF ENERGY

Grade Level K-3

Purpose: To help children understand why our bodies need energy and where that energy comes from.

Concept: Energy is a fixed commodity being neither created nor destroyed but converted from one form to another. The means of conversion and the by-products of this conversion are important.

Materials: Paper
Crayons
Picture sources such as magazines

Activity:

1. Do a short series of physical exercises: walk, hop, skip, jog and run a measured distance. Ask the children to determine which method of movement required the most work and tell why.
2. Find pictures of different types of food and try to classify the foods as primarily plant or primarily animal.
3. Discuss which animals give us beef, pork and other meats. What in turn are the foods for these animals?
4. Discuss the parts of plants which we eat: stems, roots, leaves or seeds.
5. Make a cooperatively developed bulletin board entitled, "Where We Get Our Energy".

Energy: A Teacher's Introduction to Energy and Conservation,
Ohio Department of Education, Columbus, Ohio, 1975.

ENERGY GRAB-BAG

Grade Level 2-3

Objective: To discuss different energy sources

Activity: Students will work in groups of 3-5 students. Each group will be provided with a grab-bag which will contain items representing an energy source. The students will take out the items one by one and discuss what type of energy source it may represent.

Examples of items which may be in the bag are:

- Aluminum foil (reflect solar energy)
- Picture of a geyser (geothermal)
- An article of trash (burning garbage)
- Battery (electrical)
- Shale (oil from oil-bearing shale)
- Child's twirly bird (windmills)
- A Card with an H on it (Hydrogen)
- Model of an atom (nuclear)

Discussion may also involve classifying the energy sources, such as mechanical, electrical, chemical, radiant or nuclear. This can be adapted for different grade levels.

This lesson would also be very effective as a learning center with a tape recorder.



DESIGNING WARM HOUSES

Grade Level K-3

Purpose: For the student to understand how different designs can add to energy conservation.

Concept: The sun can be used to heat.

Materials: Lab thermometer
Small dishes for water
Paper or cardboard for houses

Activity:

On a sunny day in the early spring take the class into a room on the sunny (south) side of the school. Then go into a room on the shaded (north) side of the building. Ask the children if the air temperature in the two rooms felt different. Discuss the fact that the first room felt warmer and that the sun had warmed it. Ask which side of the school usually gets most of the sun. If the children cannot remember, take the class outside at different times on a sunny day. They will probably discover that one side (south) gets the most sun, while one side (north) gets less. Explain that the side facing the sun should have many large windows to take advantage of the sun's warmth and that the opposite side of the building should have fewer windows. Encourage the children to plan and build several diorama "houses" which would utilize the sun's warmth for heating. Place the completed houses on the window ledge in a sunny room. Discuss with them how the houses should be oriented. To test their hypothesis, several houses should have the big windows facing away from the sun. Place small dishes of water in each of the model houses. After several hours, have the children test the temperature of the water with a lab thermometer.

1. In which of the model houses would the children expect to have the water feel warmer? Why?
2. If real houses were built with many windows facing the sun how would that affect the amount of fuel necessary to heat them?

Living Within Our Means: Energy and Scarcity, Environmental Education Instructional Activities, K-6, Yorktown Heights, New York.

3. What problem might occur in the summer? (excess heat)
4. How could this problem be prevented? (house design, proper roof overhang relative to sun angle, deciduous trees; awnings)

WORLD ENERGY RESOURCES

Grade Level 2-3

- Purpose: To enable students to conceptualize the geographic location and distribution of the world's supply of fossil fuels.
- Concept: Presently, most of our energy requirements are met through using fossil fuels. However, there are other alternative sources of energy such as solar, wind, fission, fusion, hydrogen, hydro, and geothermal which must be considered and developed.
- Reference: Mengel, Wayne. Energy, Key to the Future, Teaching Techniques for the Understanding and Conservation of Energy, Dutchess County Board of Cooperative Educational Services, Poughkeepsie, New York.

Activity:

Energy resources, such as oil, coal, and natural gas, are located in different geographic regions of the world. Have students research the known energy resources, their location and the geographic characteristics that indicate a possible fossil fuel reserve. On a map of the world, have the students locate these energy resources using different colored map pins for each fuel.

Once the energy resources have been located, have the students decide which countries have the most fuel reserves and which countries have the greatest demand for those energy fuels. Discuss what problems result in this supply/demand imbalance.

ERIC: Energy Activities for the Classroom.

SOLAR HEATER

Grade Level 1-3

Purpose: To demonstrate how a solar heater can be used to heat water for home use.

Concept: Using a simple apparatus, water can be effectively heated by the sun (a free energy source) for use in the home.

Materials: Scrap wood sufficient to build a box roughly 33 cm x 72 cm x 8 cm, 5 meters black vacuum hose, one sheet of template cut in strips, thumb tacks, one gallon can, two electrical althread nipples, four nuts, four washers, graphite string packing. (Be sure the nipples fit the hose.) Clear plastic to cover. See model on following page.

Activity:

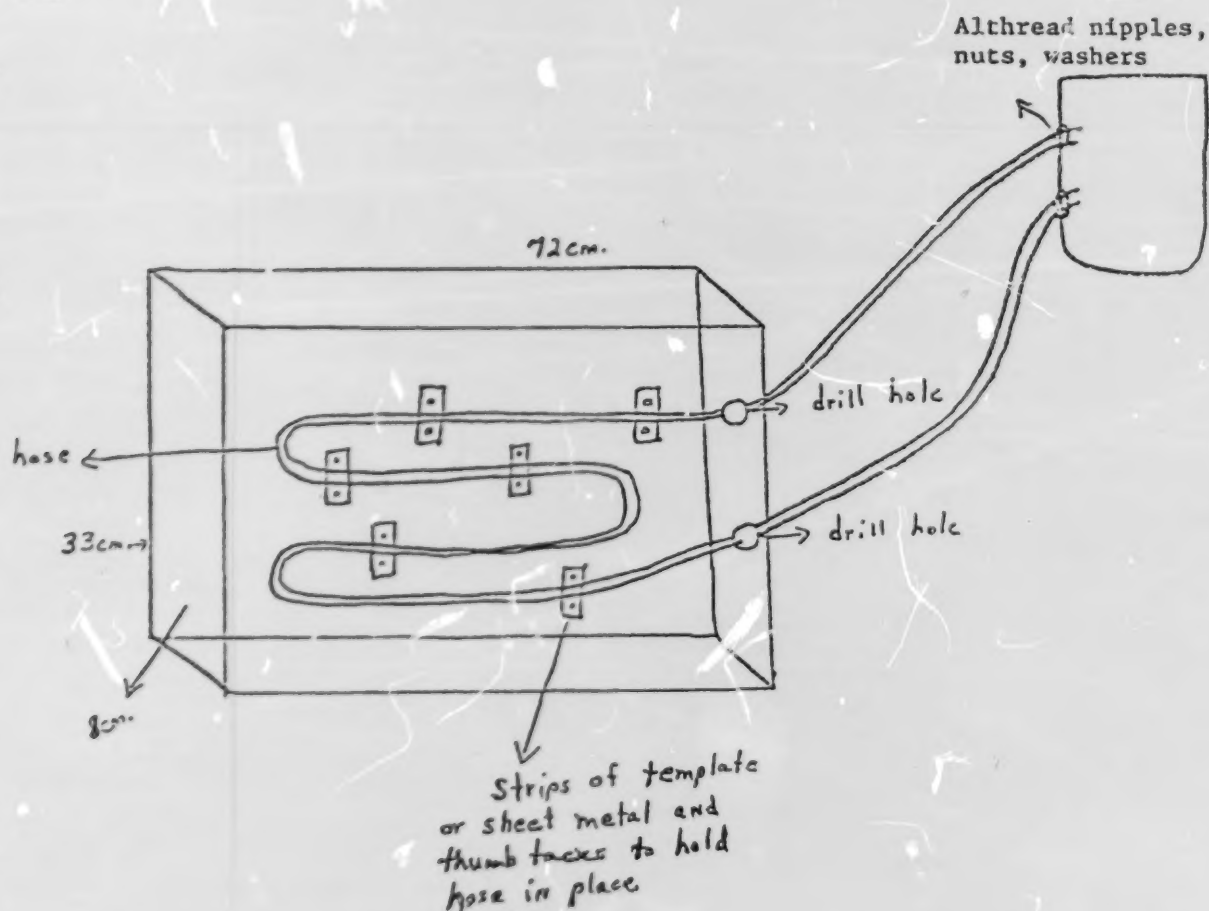
1. Construct box, paint black (flat black paint).
2. Cut templates, 2 cm x 8 cm (paint black).
3. Drill holes in box.
4. Place and anchor tubing in box with black tacks.
5. Put nipples in can so hose can be put into can.
6. Fill system with all the water it will hold. Blow out excess air. Cover box with clear plastic.
7. Set solar box so it will receive maximum sunlight to the inside of the black box.
8. Measure temperature of water at intervals of five minutes.
9. Observe movement of water, through the system. Move the system to keep the sun on it to keep it efficient (each 20 minutes or so).

Questions:

1. What makes the water temperature rise?
2. What causes the water to move?
3. Why is everything inside the box black?
4. Should the can be black? Why?
5. Should the can be insulated? Why?
6. What happens if you add more turns in the tubing?
7. What happens if you tilt the heater away from or towards the sun?
8. Is there a maximum temperature the heater can produce?

Robert Walsh, Sixth Grade Teacher, North Enid, Oklahoma.

- (9) What happens if you stand the heater on end?
- (10) What happens if you color the liquid? (Food coloring)
- (11) What happens if you paint the can black?
- (12) What happens if you insulate around the can?
- (13) What happens if you take the plastic wrap off?
- (14) What effect will adding reflectors along the sides of the heater produce?
- (15) What happens if you use clear plastic tubing?
- (16) Does the outside temperature make a difference? Why or why not?



SOLAR OVEN (Modified)

Grade Level 1-3

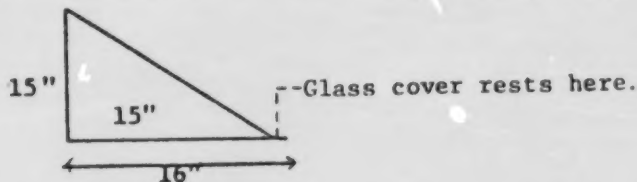
Purpose: To help the student recognize solar energy has potential to become an important alternate energy source.

Concept: Direct energy from the sun (solar) may be used to cook many foods. The energy source is free.

Materials: Cardboard box
Aluminum foil (heavy duty)
Insulation
Sheet metal or template painted with flat black paint
(paint must withstand high temperatures)
Oven thermometer
Glass cover (safety glass) which is clear, not tinted
Black pan for cooking
Food to cook
Stiff cardboard or thin plywood for reflectors

Activity:

Measure 16 inches across the bottom of the box and 15 inches high and cut box at 45 degrees angle. Line inside of box with aluminum foil so that it overlaps outside the box. Cover the outside of the box with foil also. Place a one-inch layer of fiber glass insulation inside the box (bottom, back, and ends). Use the sheet metal or template to make the inner oven wall. Paint black using flat paint which can withstand high temperatures. Cover the solar oven with glass. Duct tape around edges of the glass makes it easier and safer to handle. Tilt toward the sun. You can achieve approximately 300 degrees Fahrenheit (150° C) with this heater. To increase the temperature, make four reflectors the same size as the glass cover and tape them to the oven, reflecting more solar energy into the oven. To make a reflector just cover stiff cardboard with aluminum foil. Use a heavy black pan to cook in.



Side view of oven

ERIC/SMEAC: Energy Activities for the Classroom, modified by Pat Kellogg, Ada Middle School, Ada, Oklahoma.

SOLAR ENERGY

Grade Level 1-3

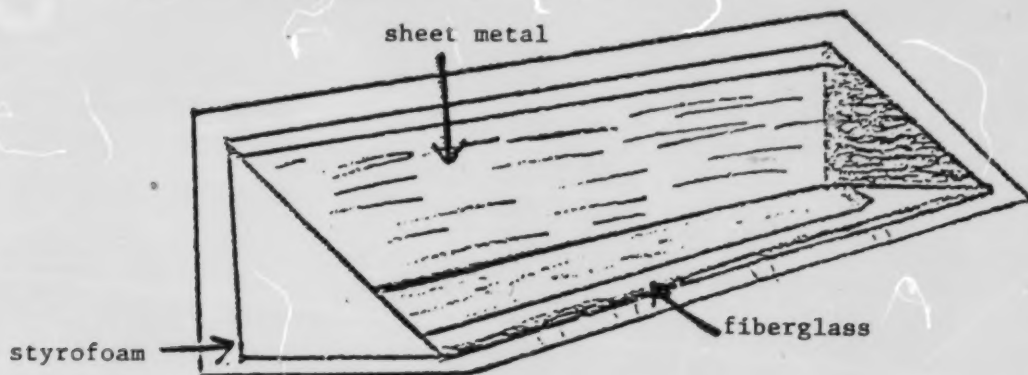
Purpose: To demonstrate how solar energy can be transferred to heat energy for our homes.

Concept: Presently, most of our energy requirements are met thru using fossil fuels. However there are other alternative sources of energy such as solar, wind, fission, fusion, hydrogen, hydro, and geothermal which must be considered and developed.

Reference: Daniels, Farrington. Direct Use of the Sun's Energy, Ballantine Books, New York. Science Teacher, Vol. 39, March 1972, Page 36, "Solar Energy". Activity suggested by Joy McDonald, Teacher, East Elementary School, Urbana, Ohio.

Activity: 1. After some simple experiments to show the heating power of the sun, involve the students in constructing a solar-radiation oven. Materials needed are: About 30 sq. in. of sheet metal painted one side with flat black paint; 1-5/6 sq. yd. of 2- to 4-inch styrofoam or a wood frame; 1-5/6 yd. of 1-inch fiberglass insulation; and a glass cover for the front. An oven thermometer and one to check water temperature would also be useful.

Students should dry apples, heat water, and bake cup cakes or do other cooking in the solar oven.



2. Plan a field trip to a solar-heated home to understand how this can operate.

3. Show transparencies and slides of solar radiation collectors, cells, furnace, solar-powered steam engines, projected satellite solar-power station, and solar-heated homes. Discuss.

SOLAR COOKING

Grade Level 1-3

Purpose: To recognize the potential value of direct sunlight in providing some of our energy needs.

Concept: By reflection, solar energy may be used to cook food.

Materials: Paper Clips (large)
 Rubber Cement
 Umbrella
 Poster Board
 Aluminum Foil
 Skillet (black all over)
 Oven Thermometer
 Food to cook

Cost--\$5.00-\$7.00

Activity: Procedure--

Open the umbrella, measure the panels and cut new panels out of poster board large enough to overlap slightly. Cover each poster board panel with rubber cement then heavy weight aluminum foil. Use paper clips to mount these panels inside the open umbrella. Measure the radius of the umbrella. Cut off the handle to the same length as the radius of the umbrella. (A string may be used to measure the radius. Use this pointer to direct the umbrella toward the sun. Locate the hot spot (focal point). Put the skillet over the hottest spot and cook some food. To increase efficiency, cut a hole in a paper plate the size of the pointer, cover the plate with foil and lay it over the pointer pushing it down to the center of the umbrella. This helps hold the panels in place.

Example: If the diameter of the umbrella is 36 inches then the length of the pointer should be 18 inches

$$\text{radius} = \frac{\text{diameter}}{2}.$$



Paper plate covered with foil

Robert Walsh, Teacher, North Enid, Oklahoma, Schools.

CONSTRUCTING A WINDMILL

Grade Level 1-3

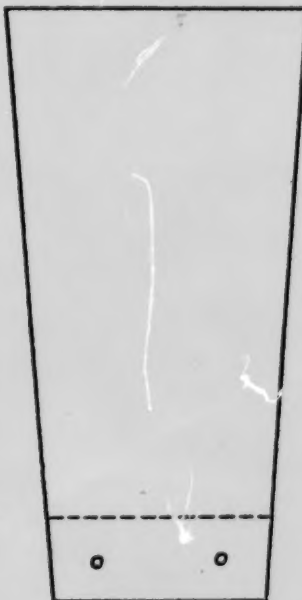
Objective: To demonstrate that wind can be used to do work.

Materials: Old bike wheel, front braces (fork) of frame that holds wheel, pipe, metal sheeting, rivets, or nuts and bolts. Flat strips of metal bracing approximately 3/16" thickness.

Activity: Cut metal sheeting into a 12" x 8" rectangular shape (direction of wind) rounding off the corners. Next cut and extend by a weld or nuts and bolts the frame that holds the wheel in place (step #2 on drawing). Place wheel into grooves so that it may rotate (turn). Now cut metal flaps or blades that will be attached to wheel. Bend and rivet into place. Step 5 will need a weld to the frame extending outward (flat strips to frame). Large 12" x 8" sheet is now attached to metal strips. To mount the windmill a piece of pipe may be attached to a pole and upper end of front wheel brace (fork) lowered into pipe. Windmill should now rotate and turn according to the wind.

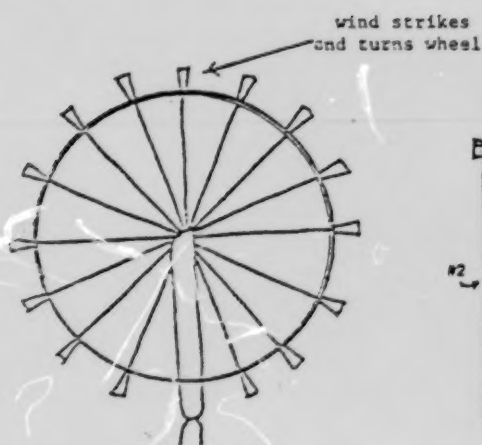
actual size

bend

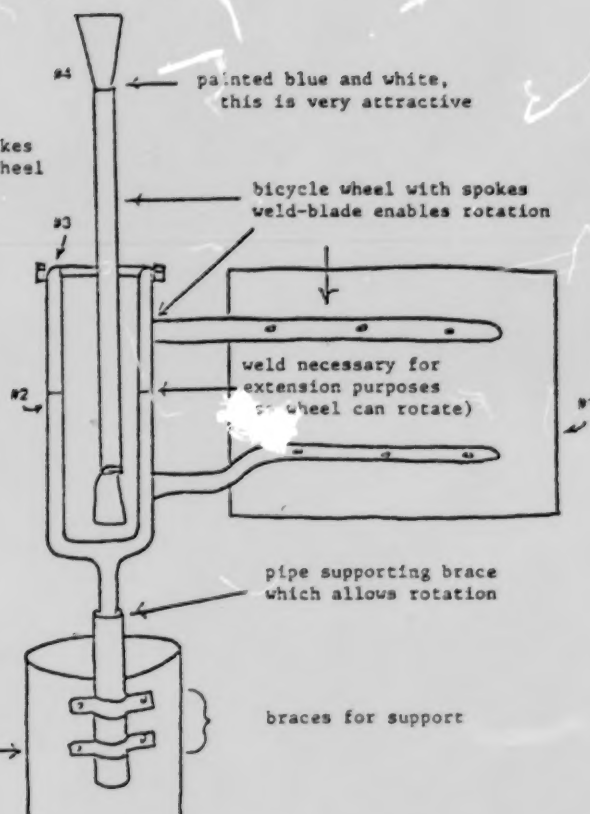


holes drill to attach blade to wheel

side view of windmill
showing direction of wind



post, pole, etc.,
for holding windmill

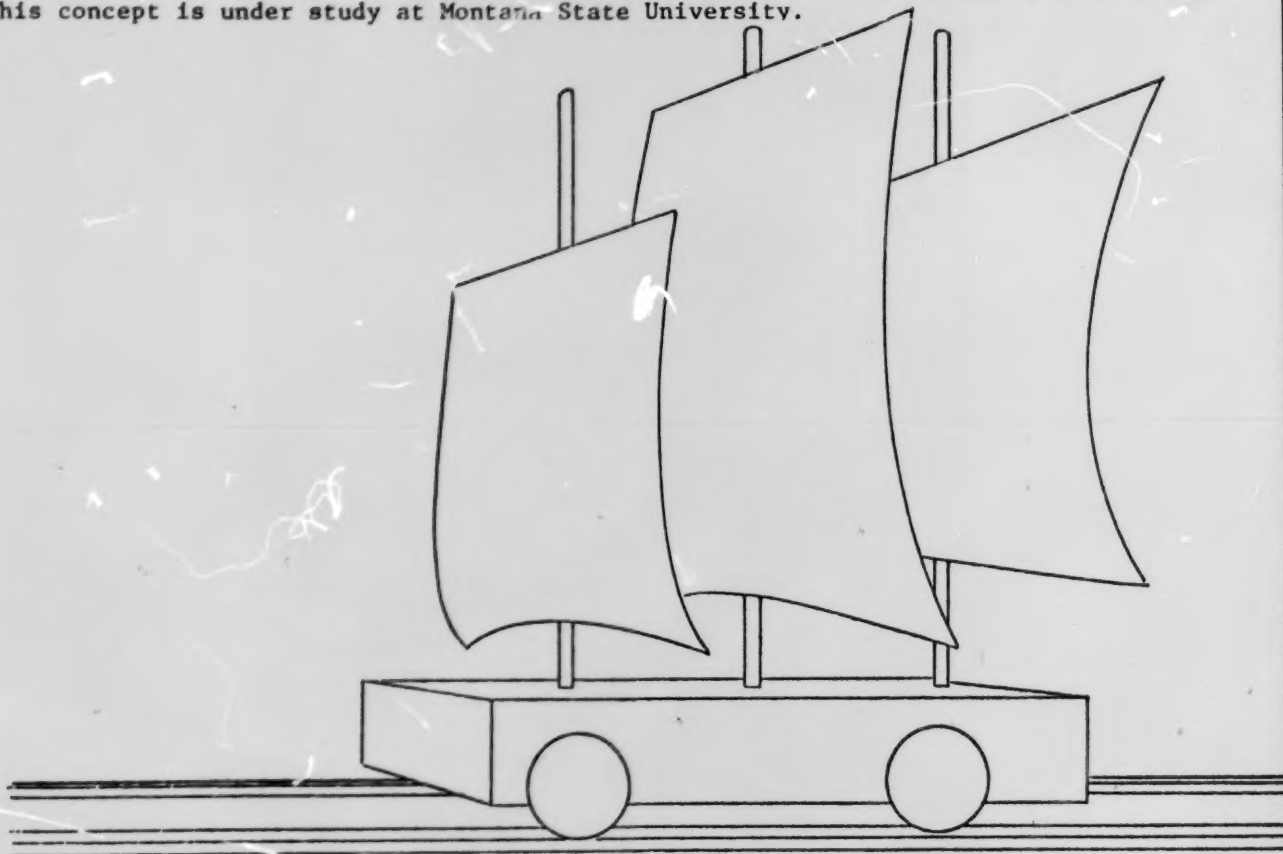


This model can also be erected and accurately used as part of a homemade weather station (determining both speed and direction of the wind). Efficiency test--try it with vanes mounted between the spokes.

SAIL-TRAIN, same principle as car

Grade Level K-3

It would drive a generator to feed a storage device, or connect directly to high lines. This concept is under study at Montana State University.



ENERGY CONSERVATION

Grade Level K-3

Concept: Energy conservation is the key to having energy for the future.

Materials: Energy Book 7, Conservation checklist

Activity:

1. Develop the meaning of "conserve".

"What would happen if we used all our coal, oil, and gas? (Must find other forms or we'll be cold and hungry.) If we use less coal, oil, and gas now by not wasting it, will we have some later to use? When we save energy by using less coal, oil, and natural gas, we say that we 'conserve' it."

Have group pronounce "conserve".

Ask several students to use it in a sentence.

2. Demonstrate examples of energy conservation using Picture Book 7.

Distribute copies of Energy Picture Book 7 to the entire class and guide picture interpretation by asking:

- a. Title Page

"What does our title page say? What does it mean?"
(Energy can be saved)

- b. First Page

"What is shown in this picture? Where might these people be going? How else could the people get where they are going? Do people save energy by using bicycles rather than cars? What form of energy do you use when you ride a bicycle? A car? Which would you choose?"

- c. Second Page

"Describe what is happening in this picture. When do we need the lights on? When should we turn them

off? What else is light used for besides helping us to see?"

d. Third Page

"What is happening in this picture? How warm should we keep our home and school? What can you do to keep warm without increasing the heat?"

e. Fourth Page

"What is happening in this picture? How are storm windows useful? Are there any other things around a house that we can do to keep our homes warm in winter and cool in summer?"

f. Fifth Page

"How are these people saving energy? How else might they get where they are going? How are the children in sweaters saving energy? Do you know any other ways to save energy?"

3. Evaluate student knowledge of energy conservation methods. Pass out conservation checklist. Explain that there are two pictures in a set—one showing a way to save energy and one showing a way to use more energy. Have students check the pictures which show how you can "conserve" energy. Allow time for students to complete this activity. Then correct and briefly discuss it.
4. Students may color favorite pictures and add these to energy folder. They may want to share these folders with their families or with other classes.

Optional: Class may go on a field trip to a mine, power plant, oil field, or any other place related to their study of energy.

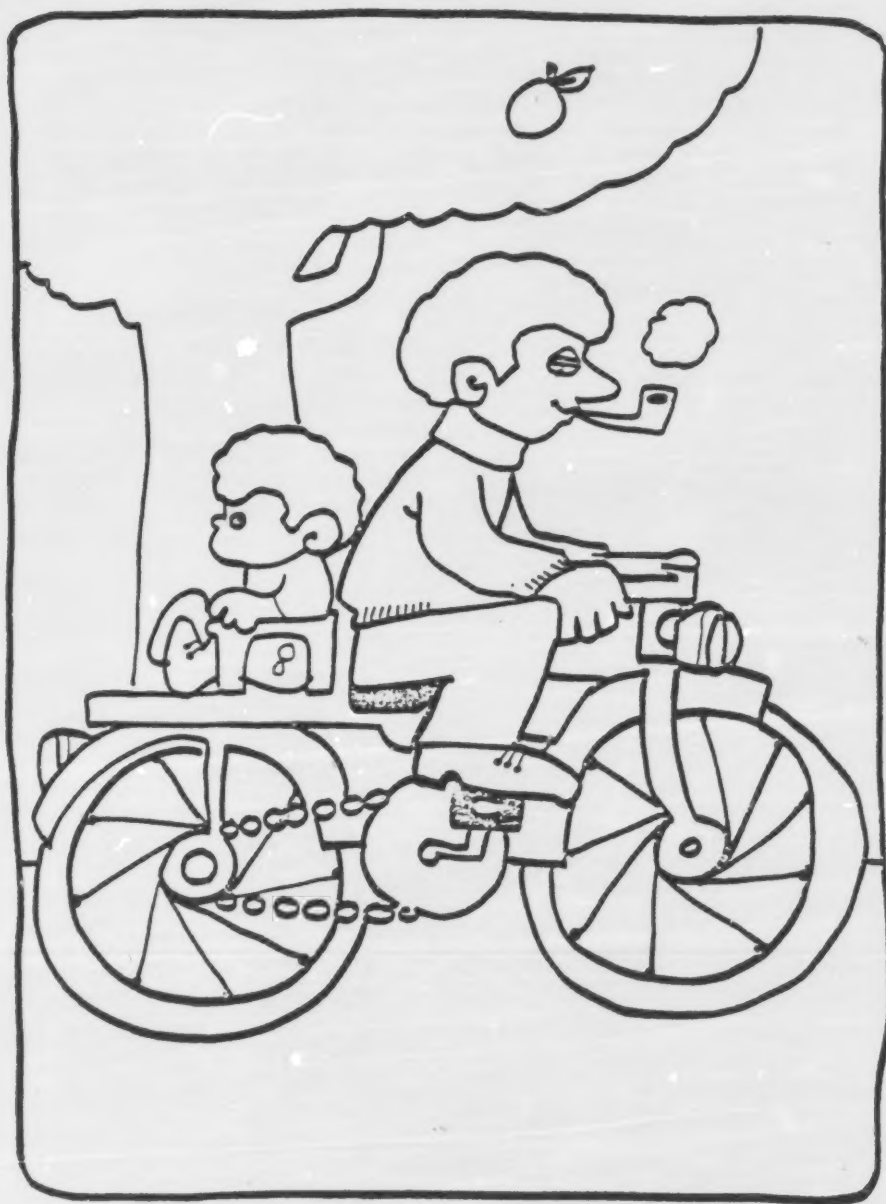
BOOK SEVEN



ENERGY

can be

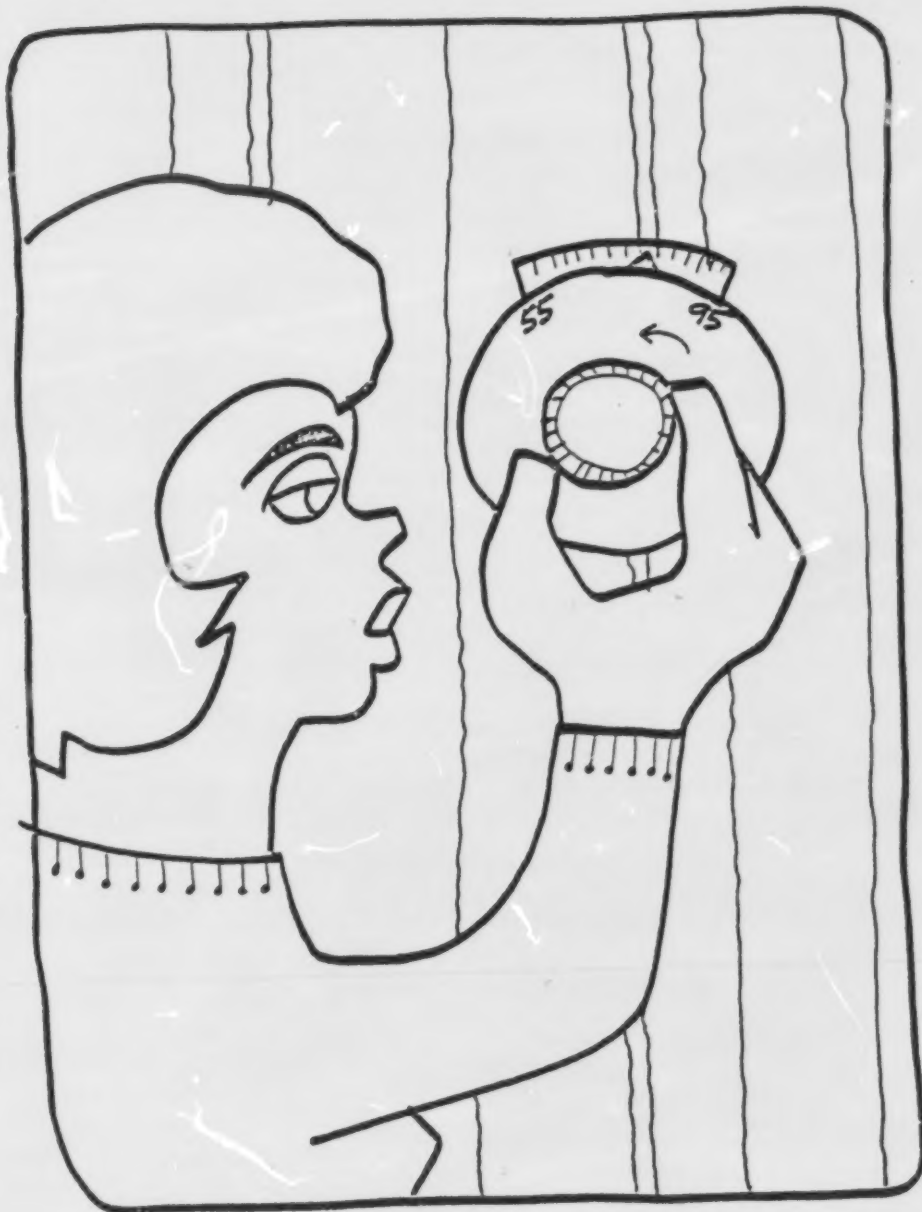
CONSERVED



200

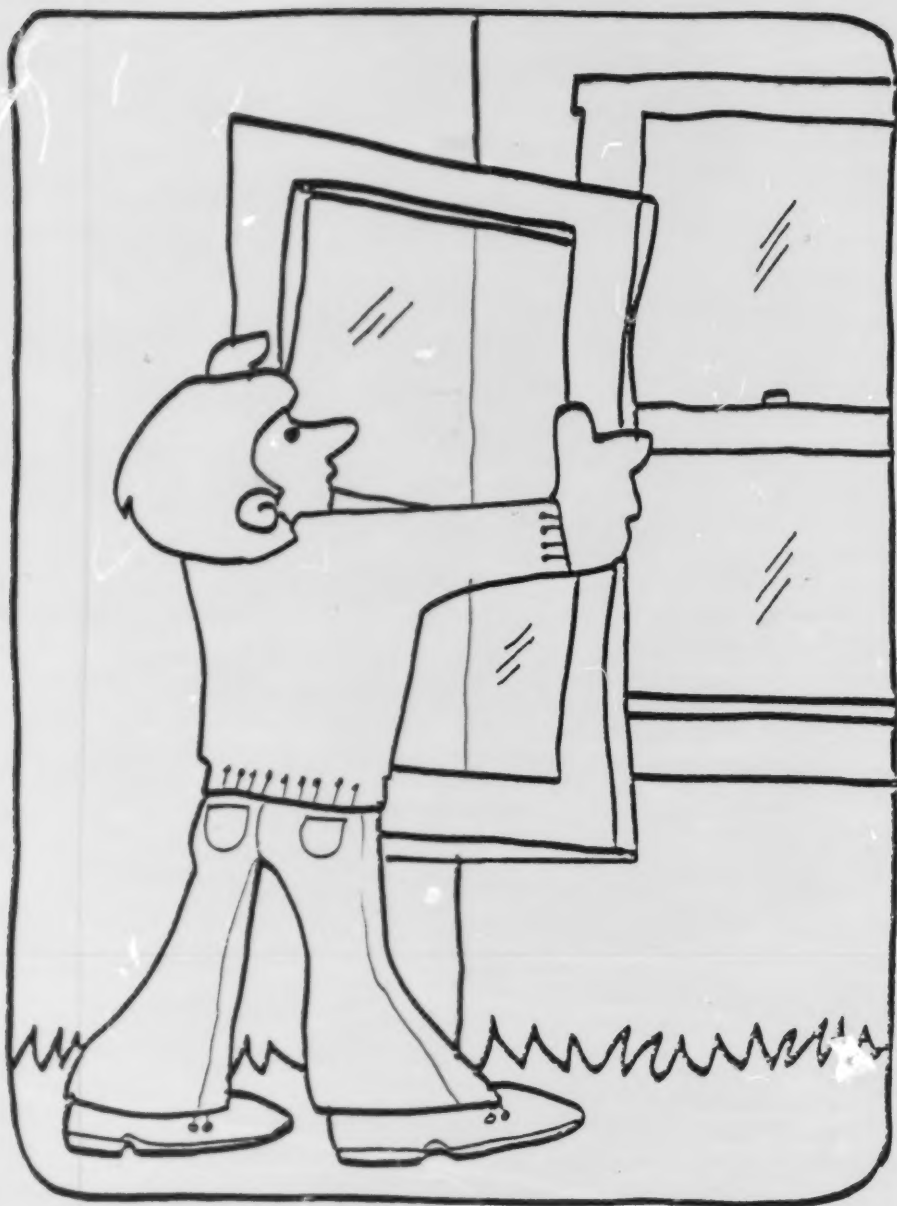
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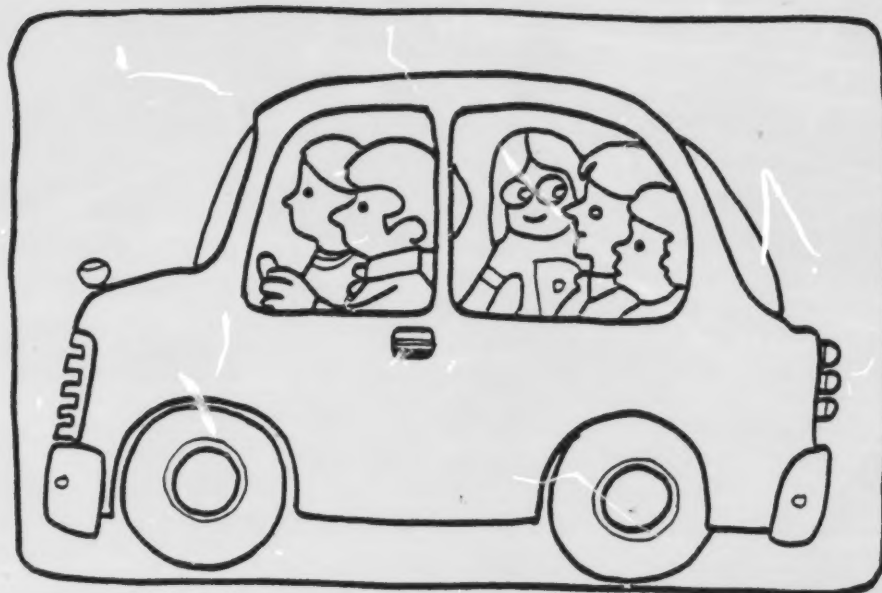
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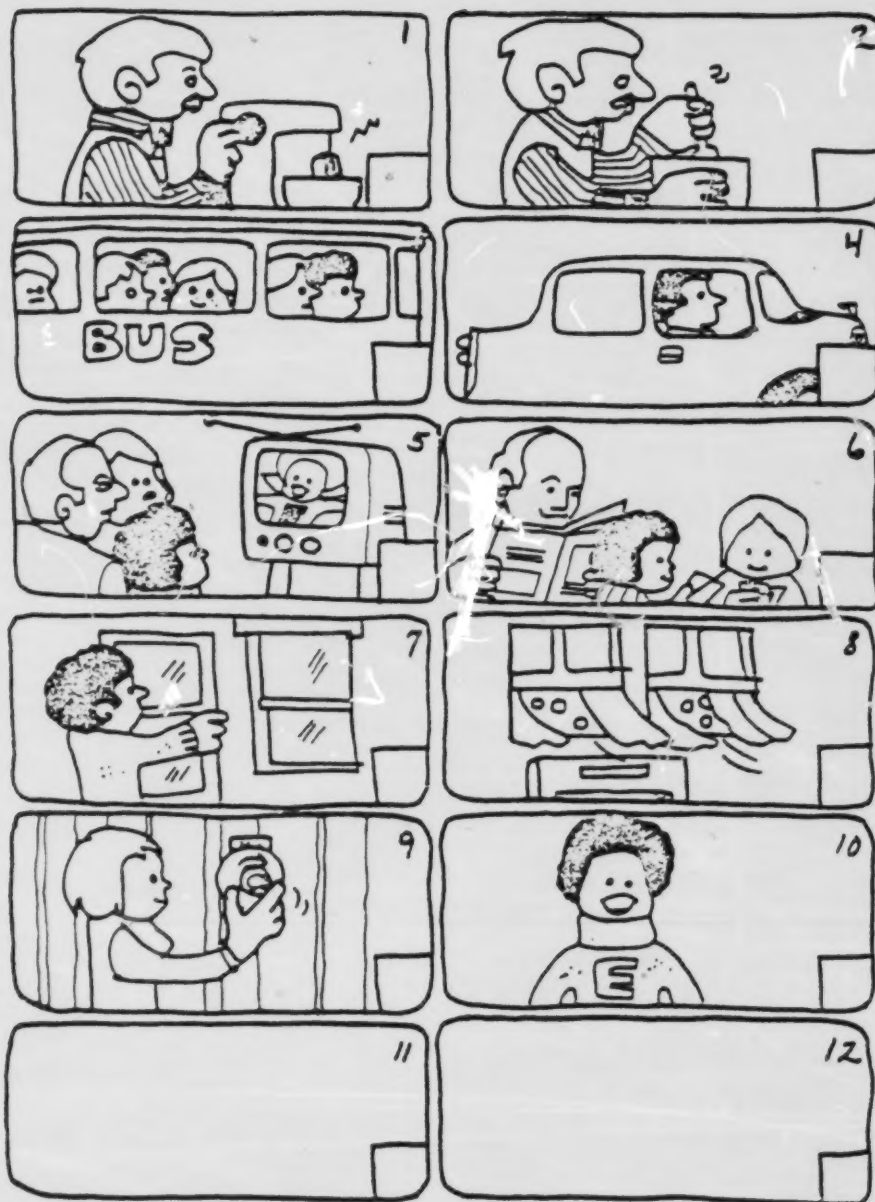


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Conservation Checklist



GOIN' FISHIN'

Grade Level K-3

Purpose: To review some of the by-products and uses of coal, oil, gas, and electricity.

Materials: Goin' Fishin' Sample Cards

Activity:

Students will play a classroom game, "Goin' Fishin'", to review some of the by-products and uses of coal, oil, natural gas, and electricity.

Advance preparation: Cut out sample drawings or have students collect magazine pictures of similar items and attach each picture to a separate 3" by 5" index card. (Cards may be in shape of fish.) Place a paper clip on each card. Also bring in a cardboard box for the cards.

Make a "fishing pole" by affixing a string to a yardstick or pole and attaching a magnet to the string.

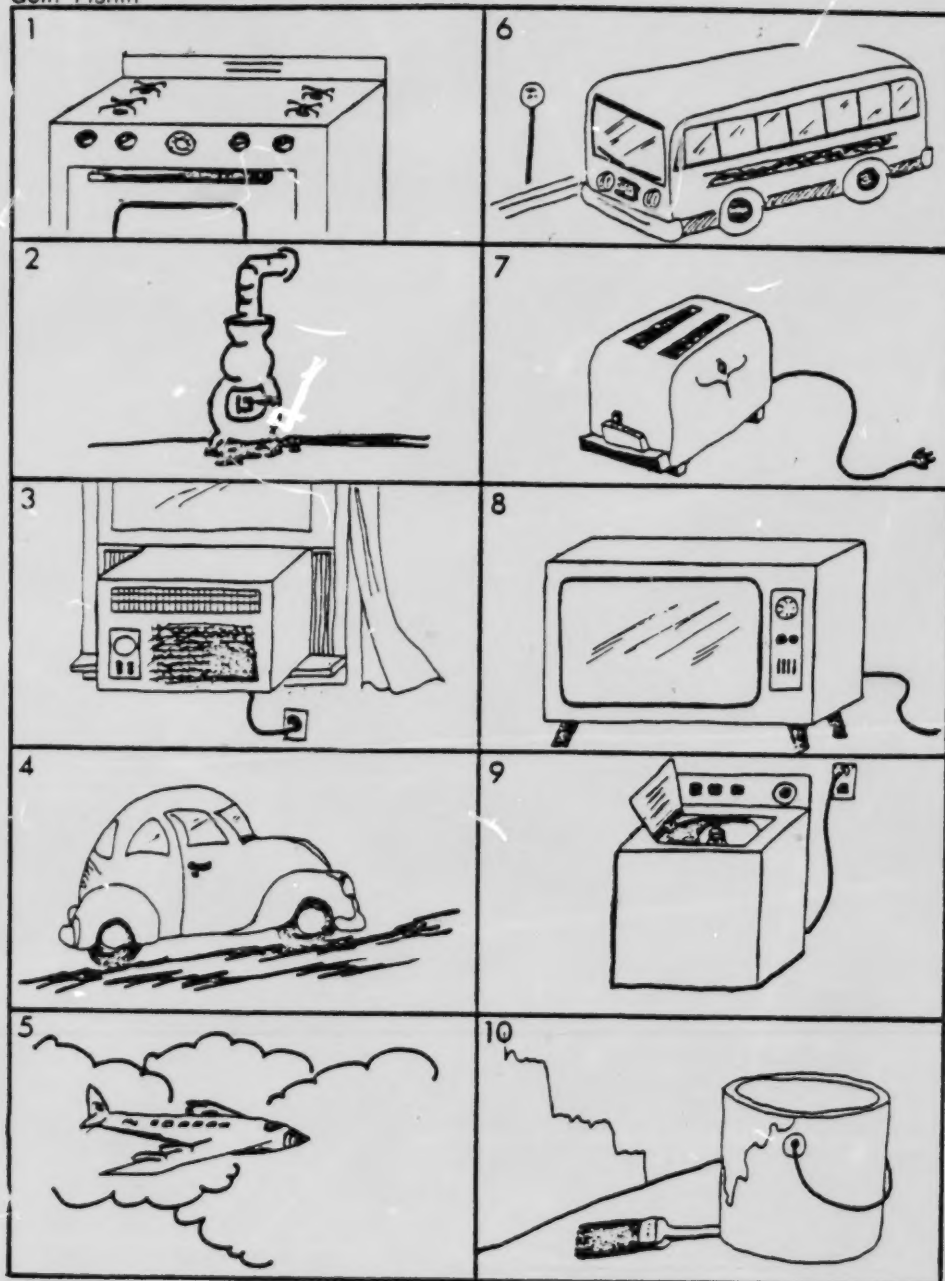
Directions: Divide class into two teams. Each student "goes fishing" by lowering magnet into the box filled with picture cards. When he "catches" a card, he looks at the picture and tells which source of energy powers the object or is used to make the object. If student answers correctly, his/her team gets a point. The team with the most points wins.

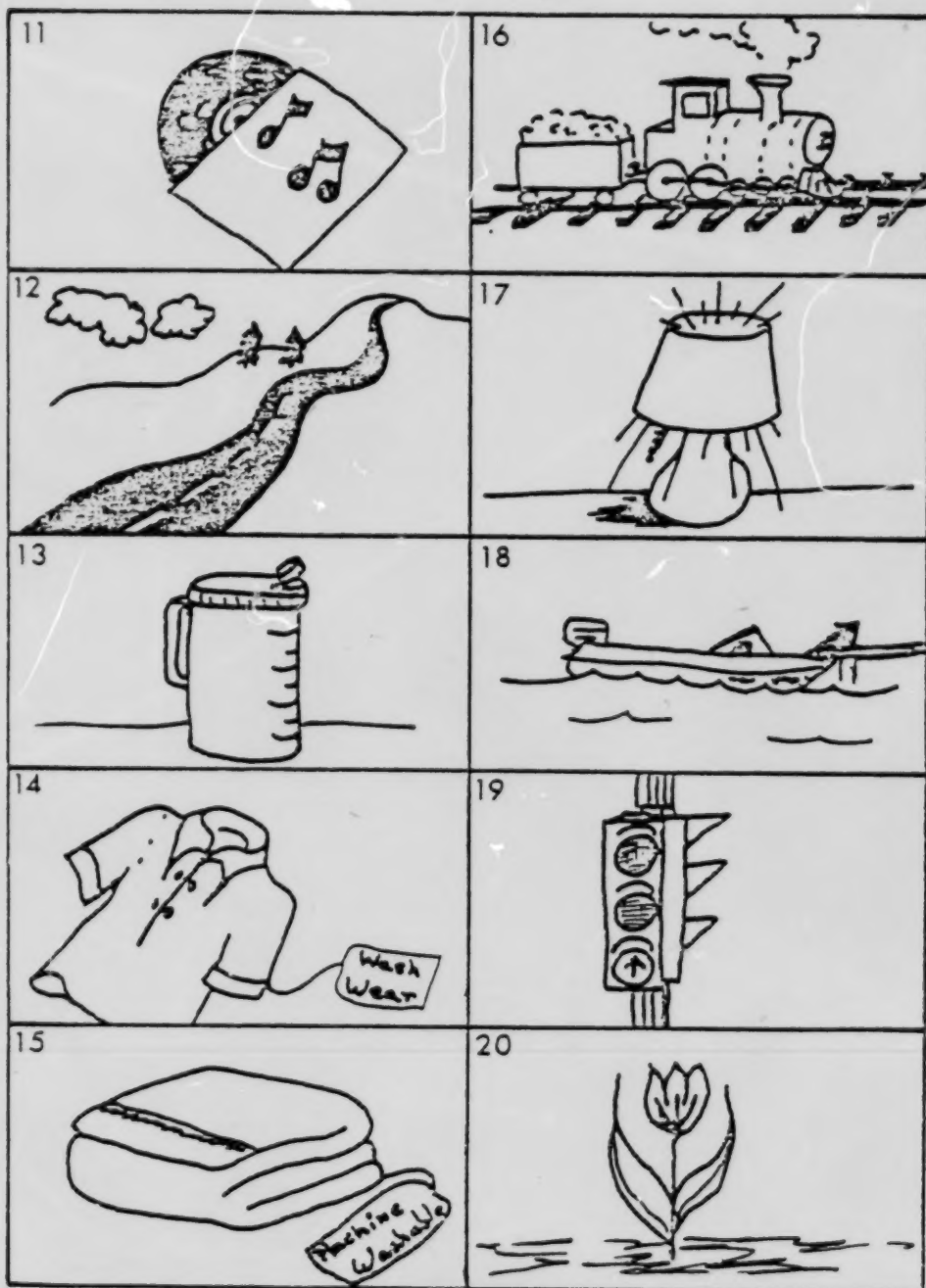
Suggestions for energy card pictures:

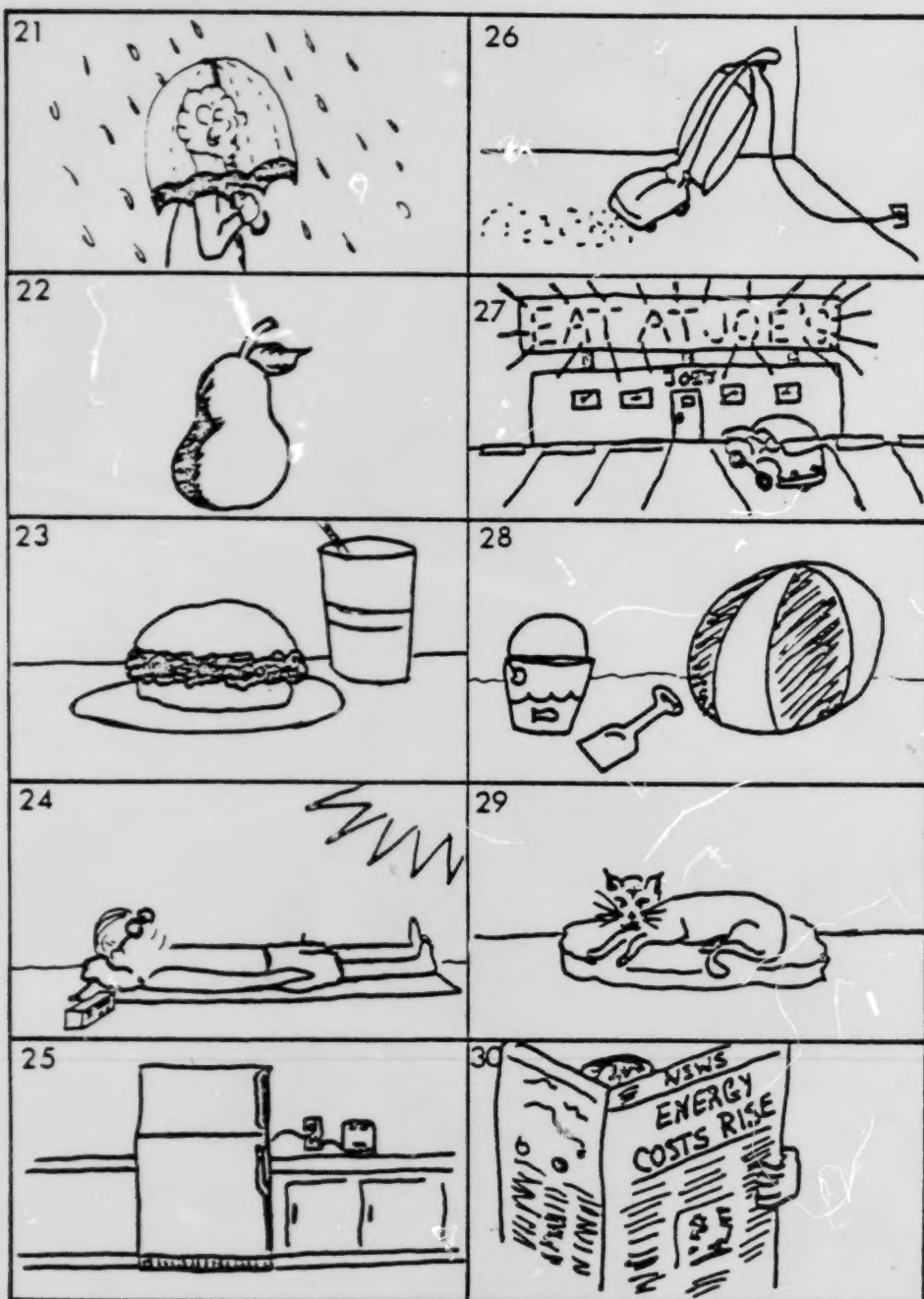
1. Gas stove (gas)
2. Potbellied stove (coal)
3. Air-conditioner (electric)
4. Car (oil)
5. Airplane (oil)
6. Bus (oil)
7. Toaster (electric)
8. TV (electric)
9. Washing machine (electric)
10. Paint (coal)
11. Record (coal)
12. Asphalt road (oil)
13. Plastic container (gas-oil)
14. Shirt (gas-oil)

15. Blanket (gas-oil)
16. Train (oil)
17. Lamp (electric)
18. Boat (oil)
19. Traffic light (electric)
20. Flower (sun)
21. Umbrella (gas-oil)
22. Pear (sun)
23. Hamburger (sun)
24. Person (sun)
25. Refrigerator (electric)
26. Vacuum cleaner (electric)
27. Neon sign (electric)
28. Plastic toy (gas-oil)
29. Cat (sun)
30. Newspaper (sun)

Goin' Fishin'







ENERGY PRIORITIES

Grade Level 1-3

Purpose: Student will explore man's dependence on energy in our society.

Concept: Energy, it's production, use, and conservation are essential in the maintenance of our society as we know it.

Materials: Paper and pencil

Activity:

The student will state at least three advantages and disadvantages of using each of the following electric appliances:

1. Toothbrush
2. Toaster
3. Hot water heater
4. Freezer
5. Lights - incandescent and fluorescent
6. Space heating
7. Air conditioning
8. Radio
9. Television
10. Range
11. Dishwasher
12. Rotisserie
13. Radar range

The student will list five different electric appliances used in his/her home which the family could most easily live without. He/she will state reasons for this decision and describe what effect this would have on his/her family.

FAMILY LIFE

Grade Level 1-3

Purpose: The rate of resource consumption increases in direct proportion to the expansion of our wants, needs and markets. Our wants and waste of natural resources can limit the options available to future generations.

Concept: Energy, it's production, use and conservation are essential in the maintenance of our society as we know it.

Materials: Pictures of families

Activity:

Compile or collect a series of pictures showing families participating in everyday activities such as eating meals, having a picnic, or watching television. Ask the children to identify each member of the group and to tell what kind of activity the group is engaged in. Compare pictures and note similarities and differences. To develop an understanding of family life in the past, ask if the children think families of long ago (when their grandmothers were little) were like theirs today. Have them guess what family life might have been like and compile a list of their guesses. To verify which guesses were correct, invite at least five grandparents or members of a local senior citizens group (particularly people who have lived on a farm) to the class. Have them verify through their recollection which ideas of the children were correct. To facilitate the discussion and the grandparents' descriptions, the following outline might prove helpful:

1. Where did people live?
2. What was the family like?
3. What kind of home did they have?
4. What kinds of work were done by the "breadwinners"?
5. Things that were better or problems we didn't have.
6. Things that were worse or harder or problems we did have?

After the panel discussion among the class and the grandparents, have the children begin to compile a

Living Within Our Means: Energy and Scarcity, Environmental Education Instructional Activities, K-6, New York.

diary in which the pages are folded in half. (Long Ago, Today) Either draw or collect and paste pictures of any item that has changed. For example: potbellied stove vs. furnace, hand fan vs. electric fan, horse and buggy vs. car, and long dresses vs. pantsuits.

1. Do the changes make our lives easier or more difficult? How?
2. Should we be happier or less happy than our grandparents were? Why?
3. Will any of the advantages we have be the cause of problems for us in the near future?
4. Does the way we live today cause us any serious problems that were unheard of 50 years ago? (20 million autos = gasoline shortage)

ENERGY CONSERVATION CHECKLIST

Grade Level K-3

Purpose: Energy, it's production, use, and conservation are essential in the maintenance of our society as we know it.

Materials: Pencil

Activity: Home Checklist for Energy Conservation

Heating:

- ___ Set thermostat for heat at 68-70 degrees.
- ___ Turn thermostat down at least 10 degrees at night.
- ___ Eliminate use of home air conditioning, if air conditioning must be used, adjust settings so it does not come on below 78-80 degrees.
- ___ Keep furnace filters clean for more efficient operation.
- ___ Close fireplace damper when not in use.
- ___ Open or close drapes to help control indoor temperatures.
- ___ Do not use oven for heating kitchen.
- ___ Insulate homes. An uninsulated home requires twice the energy for space heating.
- ___ Install weather stripping around all windows and doors.
- ___ Use storm windows, or cover windows with plastic during colder months.
- ___ Move obstructions away from cold air returns or hot air vents.
- ___ Thermostats should not be placed on cold walls or outside walls.
- ___ During the summer all windows that face the sun directly should be shaded.
- ___ Keep baseboards and heating surfaces clean and unobstructed by furniture or draperies.
- ___ Minimize the use of portable electric space heaters.
- ___ Keep humidity as normal as possible (45 percent to 50 percent) by using exhaust fans in high moisture areas.
- ___ Minimum settings of 55 degrees should be maintained on thermostats when leaving for a period of time; i.e., vacations, moving from the residence, etc.
- ___ Close foundation vents on the windy side of the house during cold weather.
- ___ Shut off register and heat vents in unused rooms (check to be sure there are no items in the room vulnerable to freezing).
- ___ Cover outside section of wall mounted air conditioning units with plastic to prevent air leakage.

Lights and Appliances:

- ___ Turn off all lights not in use.
- ___ Reduce bulb wattage where practical
- ___ Eliminate yard lights. Turn on porch lights only when expecting visitors. Eliminate exterior Christmas lighting.
- ___ Turn off all unused TV, radio, stereo, etc. . .
- ___ If you have a choice between color and black and white television use the black and white.
- ___ Use sunlamps, hair dryers, electric curlers, etc., only when essential.

Laundry:

- ___ Cut down on use of clothes dryers, hang clothes outside when possible.
- ___ Dry full loads, but avoid overdrying.
- ___ Set drying temperature for fabric.
- ___ Clean lint trap in dryer after every load.
- ___ Use full loads in washer.
- ___ Set water level controls to load size.
- ___ Set water temperature for fabric.
- ___ Use cold water when appropriate.

Water:

- ___ Reduce water heater thermostats to 140 degrees.
- ___ Turn electric water heaters off if you plan to be gone from home more than one day.
- ___ Take showers when possible, instead of baths; make them brief, and turn faucet only to minimum practical water flow.
- ___ Use less water for tub baths.
- ___ Drain and flush your hot water tank at least once a year to prevent build-up of sediments.
- ___ Repair dripping faucets and leaking toilet fixtures.

Dishwashing:

- ___ Wash only full loads in dishwasher.
- ___ Use shortest cycle for load being washed.
- ___ For hand dishwashing, use a pan of rinse water rather than rinsing under running water.

Cooking and Refrigerating Foods:

- ___ Preheat oven only when necessary.
- ___ Choose pans to fit units and cook with lids on pans when possible.
- ___ Keep oven door closed until food is done.
- ___ Use pressure cookers.
- ___ Use self-cleaning ovens as little as possible.

Cooking and Refrigerating Foods (Cont'd):

- ___ Don't use ovens to heat kitchens.
- ___ Set refrigerator temperature to maintain 35 to 40 degrees in fresh foods compartments.
- ___ Defrost refrigerator when frost is 1/4 inch thick.
- ___ Be sure door seals on refrigerator and freezer are good.
- ___ Clean condensor coil regularly.
- ___ Cool foods before refrigerating or freezing.
- ___ Don't overload refrigerator or freezer.

AMERICAN LIFESTYLES

Grade Level K-3

- Purpose:** To become more aware of energy wasteful habits.
- Concept:** American lifestyles require large amounts of energy.
- Materials:** Pen or pencil
- Activity:** There are many ways to conserve energy in and around the home without sacrificing our level of living. When one reduces the amount of energy used, one also saves money for other needs. Check appropriate column:

Have Done	Will Do	Personal Care
☐	☐	Minimize hot water use in bathing.
☐	☐	Check to see if less water is used in showering.
☐	☐	Do not leave water running while shaving.
☐	☐	Turn off faucets promptly after use.
Recreation and Entertainment		
☐	☐	Turn off TV, radio, or stereo when not in use.
☐	☐	Disconnect instant-on TV when you are not home.
☐	☐	Use shop or hobby equipment efficiently.
☐	☐	Maintain tools in good operating condition.
☐	☐	Spend vacations closer to home.
☐	☐	Develop leisure activities, such as bicycling, hiking, reading, swimming.
The Family Automobile		
☐	☐	Drive at moderate speed and not more than the 55 mph speed limit.
☐	☐	Don't warm up the car for more than a minute or two.

The Family Automobile (Cont'd)

_____ Provide proper maintenance; make sure you have
a well-tuned engine and properly inflated
tires.

_____ Combine errands by careful planning.

_____ Carpool whenever possible.

Cooking and Baking

_____ Use oven to capacity.

_____ Use cooking utensils which fit the electric
unit or gas burner.

_____ Use tight-fitting lids on cooking utensils
when appropriate.

_____ Reduce heat to maintain necessary cooking
temperature when using surface units or
burners.

_____ Use small appliances for cooking, baking, and
toasting if they are more efficient than the
range.

_____ Preheat oven only when necessary. Do not pre-
heat longer than needed to attain required
temperature.

_____ Turn off oven, surface units, or burners
promptly when food is cooked.

Laundry

_____ Wash only full loads of laundry.

_____ Use heated water only in the wash cycle.

_____ Use water no hotter than necessary for
adequate soil removal and sanitation.

_____ Use good laundry techniques to obtain satis-
factory results in one washing process.

_____ Avoid over-drying in the dryer.

Laundry (Cont'd)

_____ Line dry garments and household items when practical.

_____ Use the dryer efficiently. Avoid drying one or two items at one time.

_____ Remove items when dryer stops to avoid unnecessary wrinkling which will require pressing to remove.

_____ Reduce ironing to a minimum by careful selection of garments and household linens.

OPINION POLL: WHAT DO YOU THINK?

Grade Level K-3

Purpose: This activity is designed to give the student a "feel" for the energy situation. It is intended to be a quick, broad view of the energy spectrum and not an in-depth examination. Students should be encouraged to participate in this written exercise without fear of a formal test mark being applied.

This is a process where data can be assembled for discussion of research activities and where the teacher can accurately assess the level of awareness and state of knowledge of the students concerning the energy problem.

It is suggested that you have diagrams of possible answers prepared beforehand so that you can readily compile the poll results and go over them with your students, either on the first day or the next. This layout can be on paper, on the chalkboard, or on the overhead projector.

In addition, the opinion poll portion could serve as a survey instrument for your students to use in conjunction with Energy Awareness Week. Different sectors of the community (e.g., housewives, teachers) could be interviewed. The different opinions expressed could provide some interesting information.

ENERGY OPINION POLL

Directions: The following is not intended to be a test, but rather a poll to determine your opinions and feelings about the current energy situation.

- I. The following issues have received substantial attention during recent years. Please rank these issues in the order of their importance to you by placing a "1" next to the most important issue, a "2" next to the second most important issue, and so on.

- ___ Corruption in government
- ___ The energy crisis
- ___ Inflation in the United States
- ___ Middle East tensions
- ___ Environmental pollution problems
- ___ The drug abuse problem
- ___ Organized crime
- ___ Moral decay
- ___ Unemployment
- ___ Racial tensions
- ___ Other; please specify _____

- II. What do you feel are the most urgent environmental concerns? (Please rank the major categories by number in order of priority.)

- ___ Population problems
- ___ Transportation problems
- ___ Energy problems
- ___ Resource depletion
- ___ Natural environment
- ___ Aesthetics
- ___ Materialism
- ___ Planning, design, and construction problems
- ___ Economic-social-cultural problems
- ___ Knowledge gaps
- ___ Health hazards
- ___ Water problems
- ___ Land use problems
- ___ Air problems
- ___ Other(s); please specify _____



- III. Listed on the following pages are a number of statements relating to environmental issues and the energy crisis. Please indicate whether you agree or disagree with these statements by placing a check (✓) in the appropriate blank.

For example: If you strongly believe that everyone talks about the energy crisis but no one does anything about it, you would check (✓) "strongly agree" as shown below:



Strongly
Disagree

Slightly
Disagree

Neutral

Slightly
Agree

Strongly
Agree

Ex. Everyone talks about the energy crisis; no one does anything about it.

✓

1. It is more important to solve the inflationary crisis than to solve the energy crisis.

2. The energy crisis is a pressing national problem which demands real sacrifices on the part of all citizens.

3. New automobile engines have been produced which significantly increase gasoline mileage.

4. Oil companies that advertise their efforts to develop new energy sources are more concerned with public relations than resource development.

5. Although mass transit would be a good way to conserve energy, it is rarely used because it seldom meets the needs of potential users.



Strongly
Disagree

Slightly
Disagree

Neutral

Slightly
Agree

Strongly
Agree

6. We should continue to support the Israeli position in the Middle East despite the energy problems caused by Arab oil embargo of 1973.
7. Because of the abundance of coal, industries should be encouraged to switch to coal as a fuel despite the air pollution it causes.
8. One benefit associated with the energy crisis will be a reduction in air pollution due to fewer automobiles on the road.
9. The reduction of air pollution is more important than energy conservation.
10. The energy crisis should be viewed as beneficial since it will reduce auto travel as well as the accident rate.
11. Gasoline rationing would be an unnecessary hardship on our citizens.
12. Rationing of energy resources (i.e., gasoline) will be necessary in the very near future.
13. Our traditional energy resources (coal, oil, natural gas, etc.) are insufficient to continue energy consumption at the present rate.

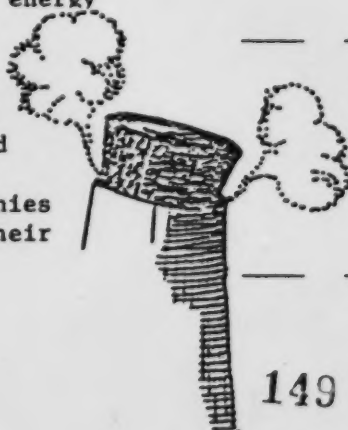
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

	<u>Strongly</u> <u>Disagree</u>	<u>Slightly</u> <u>Disagree</u>	<u>Neutral</u>	<u>Slightly</u> <u>Agree</u>	<u>Strongly</u> <u>Agree</u>
14. The 55 m.p.h. speed limit on federal highways has been effective in reducing vehicle speeds.	_____	_____	_____	_____	_____
15. Most of our environmental problems come from the misuse of energy.	_____	_____	_____	_____	_____
16. People should include as many stores as possible in a shopping trip.	_____	_____	_____	_____	_____
17. It is useless for me to take energy conservation measures seriously since my contribution won't make that much difference.	_____	_____	_____	_____	_____
18. Since every man is a consumer, it is the consumer sector that is responsible for the energy crisis and not the government or the oil companies.	_____	_____	_____	_____	_____
19. Because of the energy shortage, no television or radio programming should be permitted after 10:00 in the evening.	_____	_____	_____	_____	_____
20. It should be illegal to keep one's house warmer than 68° in the winter.	_____	_____	_____	_____	_____
21. Automobile engines that operate on fuels other than gasoline will be used in the future to conserve petroleum resources.	_____	_____	_____	_____	_____

	Strongly Disagree	Slightly Disagree	Neutral	Slightly Agree	Strongly Agree
22. Trucking companies are doing their fair share to reduce fuel consumption by observing the 55 m.p.h. speed limit on federal highways.	_____	_____	_____	_____	_____
23. Increased energy costs (i.e., gasoline and electricity) have reduced the amount of money that people have left after paying for necessities.	_____	_____	_____	_____	_____
24. Gasoline stations are making unreasonably high profits.	_____	_____	_____	_____	_____
25. Gas stations provide the same level of services now as they did before the energy crisis.	_____	_____	_____	_____	_____
26. Airlines should continue to reduce the number of flights available in order to conserve fuel.	_____	_____	_____	_____	_____
27. I make about the same number of shopping trips now as I did a year ago.	_____	_____	_____	_____	_____
28. Due to the recent introduction of anti-pollution devices on new cars, cars are no longer a serious source of air pollution.	_____	_____	_____	_____	_____



	<u>Strongly</u> <u>Disagree</u>	<u>Slightly</u> <u>Disagree</u>	<u>Neutral</u>	<u>Slightly</u> <u>Agree</u>	<u>Strongly</u> <u>Agree</u>
29. There should be more car pooling in order to significantly reduce gasoline consumption.	_____	_____	_____	_____	_____
30. Since the price of gasoline has risen significantly, people have cut down on their driving.	_____	_____	_____	_____	_____
31. Lower speed limits (55 m.p.h.) on federal highways have significantly reduced gasoline consumption.	_____	_____	_____	_____	_____
32. People with air conditioning should voluntarily keep the temperatures of their homes at 76° or above during summer months.	_____	_____	_____	_____	_____
33. The energy shortage has made our highways less crowded.	_____	_____	_____	_____	_____
34. The worst of the energy crisis has passed.	_____	_____	_____	_____	_____
35. Technological advances will produce a solution to the energy crisis.	_____	_____	_____	_____	_____
36. The government should impose rigid controls to force companies to reduce their pollution.	_____	_____	_____	_____	_____



- | | <u>Strongly</u>
<u>Disagree</u> | <u>Slightly</u>
<u>Disagree</u> | <u>Neutral</u> | <u>Slightly</u>
<u>Agree</u> | <u>Strongly</u>
<u>Agree</u> |
|---|------------------------------------|------------------------------------|----------------|---------------------------------|---------------------------------|
| 37. The energy crisis did not greatly affect my vacation plans this year. | _____ | _____ | _____ | _____ | _____ |
| 38. Oil companies should be forced to lower their prices. | _____ | _____ | _____ | _____ | _____ |
| 39. In the winter months, oil companies should reduce gasoline production in order to assure an adequate supply of heating oil. | _____ | _____ | _____ | _____ | _____ |
| 40. The government should impose rigid restrictions to make the individual citizen reduce his energy consumption. | _____ | _____ | _____ | _____ | _____ |



- IV. This section examines your opinion about different aspects of the energy crisis. There are no right or wrong answers to these situations; your response represents your opinion. (Please check (✓) the single blank in each row that best indicates your position.

For example: If you thought that the energy crisis could be described as "slightly decreasing," you would check (✓) the scale as shown below:

	<u>Extremely</u>	<u>Slightly</u>	<u>Neither</u>	<u>Slightly</u>	<u>Extremely</u>	
Increasing	_____	_____	_____	✓	_____	Decreasing

I believe the energy crisis is:

	<u>Extremely</u>	<u>Slightly</u>	<u>Neither</u>	<u>Slightly</u>	<u>Extremely</u>	
True	_____	_____	_____	_____	_____	False
Changeable	_____	_____	_____	_____	_____	Stable
Interesting	_____	_____	_____	_____	_____	Boring
Concealed	_____	_____	_____	_____	_____	Revealed
Optimistic	_____	_____	_____	_____	_____	Pessimistic
Safe	_____	_____	_____	_____	_____	Dangerous
Dishonest	_____	_____	_____	_____	_____	Honest
Unimportant	_____	_____	_____	_____	_____	Important
Old	_____	_____	_____	_____	_____	New
Relaxed	_____	_____	_____	_____	_____	Tense

- V. Without referring elsewhere, define the term "energy" in your own words:



- VI. Please circle the letter of your opinion for each question in this section.

1. What is your opinion about the energy shortage; do you think it is a temporary or short-range problem which will go away quickly, a problem which will exist for only a few years, or do you think it is a long-range problem with which we will have to deal for some time to come?

(a) a temporary problem; (b) a problem that will exist for a few years; (c) a long-range problem

2. Which of the following do you feel has contributed the most toward the current energy shortage?

(a) industry; (b) government; (c) individuals

3. How good a job do you think business and industry have done in combatting the energy crisis?

(a) excellent; (b) good; (c) fair; (d) poor

4. How good a job has the average citizen done in cooperating to reduce his energy consumption?

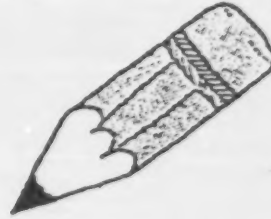
(a) excellent; (b) good; (c) fair; (d) poor

5. Do you think that the government has done enough, too much, or too little in regulating industry and business to reduce energy consumption?
(a) enough; (b) too much; (c) too little
6. All things considered, do you think citizens will, on their own initiative, further reduce energy consumption or do you think the government will have to force them to do so?
(a) will do so on their own initiative; (b) government will have to force them to do so
7. In your opinion, should any government agency take on the responsibility to regulate energy consumption?
(a) yes; (b) no
8. At what level should the primary responsibility for overseeing energy usage and establishing guidelines be, providing that such government action are found necessary?
(a) federal; (b) state; (c) local
9. If regulations for energy consumption should become necessary, which of the following sectors should be regulated?
(a) industrial; (b) commercial; (c) residential;
(d) transportation (residential); (e) transportation (commercial)



10. In your opinion, would it be acceptable to reduce consumption of energy by letting the price of energy go up so high that consumption will never exceed energy supplies?
(a) yes; (b) no

- VII. Have you done anything to help relieve energy shortages?
If so, describe below. (For example, "used less lighting
at home.")



VIII. Refer below to the "What I Personally Believe/Do Not Believe" chart. List all those things you have heard, read, or have been told regarding the energy situation under the appropriate heading. Once listed, research each statement to gather data supporting your "belief." Record any changes of your "beliefs."

THE ENERGY SITUATION

WHAT I PERSONALLY BELIEVE	WHAT I PERSONALLY DO NOT BELIEVE
Example: Energy costs more than it used to.	There's lots of oil under the Smoky Mountains.



ENERGY POTPOURRI

Grade Level K-3

Purpose: To keep students aware of current developments in energy sources, use and conservation.

Activity: The students will collect newspaper and magazine articles on energy.

Have the students prepare:

1. Energy conservation scrapbooks, containing articles, reports written by the student, pictures cut from magazines or newspapers, pictures taken by the student, cartoons, poems found or written by the student, etc. On the secondary level, students can be asked to collect articles and prepare scrapbooks on a certain topic such as saving electricity, conserving gasoline, coal gasification, nuclear power, etc., and give reports to the entire class.
2. Make collages from the articles and pictures. Prepare one with a positive outlook and one with a negative outlook.
3. Prepare bulletin boards for their own and other classrooms, either arranged around a certain topic such as conservation of gasoline, obtaining coal from the earth, nuclear power, etc., or a collage-type display.
4. Hold discussion groups centered on certain articles and editorials.
5. Stage a debate on both sides of a selected editorial.
6. Discuss vocabulary from articles (primarily energy-related words)
7. Conduct "college bowl" or "bee" types of quizzes involving the whole class and centered on energy.

TRACING OUR DAILY ENERGY USE

Grade Level 2-3

Purpose: To relate daily activities to energy use.

Activity:

Ask students to select a given period of time to analyze their own energy consumption at school. This selection can be a valuable lesson if the students are given the objective: as a group, select an hour that the most different things are likely to happen.

Direct students to list every action they take during that hour.

Then they should be asked to list the energy required for each action. For example, washing your hands and face requires hot water from the hot water tank which consumes energy from electricity, oil or gas. The students should list what they can and bring their list to class for discussion. They will need help with many of the activities. The list can get quite extensive, particularly if the energy needed to bring a slice of bread to the table from the farmer who planted the wheat is discussed.

It is also good to let them work as teams to classify the energy consumed as mechanical, electrical, chemical, radiant, or nuclear; and then let the groups compile a class listing of examples of these five forms of energy on the board.

Questions for discussion:

1. How many energy-conserving actions did you have?
2. Which of the five types of energy did you use most?
3. Which could do in such a manner as to conserve energy?
4. Which of your actions listed are the most energy-expensive?

Energy Activities for the Classroom, West Virginia Department of Education, 1975.

Extended Activity:

The same type of activity can be expanded by seeking as many different sets of classifications (headings) as can be used for the list on the board. For example, potential/kinetic or new/old or necessary/handy.

SCHOOL SURVEY OF ENERGY-USING APPLIANCES

Grade Level 2-3

Purpose: To create awareness of energy-using appliances in the school.

Activity:

1. Make a list of all energy-using appliances in the school.
2. Separate the list into essential and non-essential items.
3. By vote, select a non-essential item for your class to do without for a week.

Have each student report on their lists, and give another report after the week's trial.

Extended Activities:

1. Have students draw a floor plan of the school, locating all of the electrical outlets on the diagram. They also could mark which outlets were in use at different intervals.
2. Have a demonstration to show the time and convenience gained by using a modern electrical appliance versus its mechanical counterpart. For example, an electric knife vs. a dinner knife, electric scissors vs. mechanical scissors, hand mixer vs. an egg beater, electric can opener vs. a mechanical can opener.

Do you feel the time and convenience gained is worth the additional cost and energy consumed in every case?

3. Have students list advantages and disadvantages of various electrical appliances. Let each student draw a model "appliance" which can do the same task but uses either coal or oil rather than electricity.

ALASKA PRIORITIES

Grade Level 2-3

Purpose: To recognize our dependence on appliances.

Materials: Pencil

Activity:

Jim and Pat Kelly are building a cabin in wilderness area in Alaska. They will have no electricity (even though it is available in a nearby town where Mr. Kelly works), but that's the way they want it. They have some strong convictions about living simply. But, there are few people like the Kellys. Many people cannot imagine life without electricity. They consider it absolutely essential to a continued high quality of life. How do you feel about the use of electricity? Place a check in the column which best describes your attitude toward doing without each of the following electrical items:

	Very Easily	Easily	With some Difficulty	With great Difficulty	Impossible
Radio					
Stereo					
Air conditioning at home					
Air conditioning at work/school					
Dishwasher					
Clothes washer					
Iron					
Electric stove					
Refrigerator					
Lights					
Central heating					
Doorbell					
Ice crusher					
Toaster					
Hair dryer					
Television					
Electric fans					
Clocks					
Vacuum cleaner					
Microwave oven					
Freezer					
Blender					
Electric blanket					
Electric typewriter					
Thermostatic controlled furnace					
Electric can opener					
Telephone					
Electric toothbrush					
Electric frying pan					
Water heater					
Garbage disposal					
Trash compactor					
Power tools					

THE "GOOD OLD DAYS"?

Grade Level K-3

Purpose: To consider the different lifestyles caused by modern energy-consuming devices.

Materials: Magazines

Activity:

1. Ask students to bring in household implements or pictures which use only mechanical energy or human energy that are used today, as well as examples of those used years ago. For example: washboards, egg beaters, can openers, butter churns, apple peelers, etc.
2. Each student should also try to bring in a sample or picture of the modern equivalent of each. For example, the modern equivalent of an egg beater would be an electric mixer. A comparison of early automobiles with current models would be appropriate, along with modern "extras"--self-starters, automatic windshield wipers, air conditioning, etc.
3. Assign students to talk to parents and grandparents about the change in household appliances, automobiles, leisure activities and general change in life style relating to modern time-saving devices.
4. A time-use demonstration may be helpful. For example, a mechanical can opener vs. an electric can opener.

Questions for discussion reports and research:

1. In the days before electricity, what was the equivalent of our present-day irons? toasters? televisions? electric lights? ranges? stereos? dishwashers? hot water heaters? freezers? washers? dryers?
2. Why the changes? What brought them about? Why do people purchase modern energy-consuming appliances rather than those which use only mechanical energy? Are there any that we could do without?
3. What effect has the automobile had on life styles, politics, business, education, etc. What about television, household electrical appliances?

Energy Activities for the Classroom, West Virginia Department of Education, 1975.

4. List the reasons why you would have enjoyed living before electricity was in use in homes and before the automobile. List reasons you would not enjoy it.
5. What in your opinion would happen today if electricity were permanently shut off? What about gasoline? Would we survive as well as our forbears? Why or why not?

HOME ELECTRICAL APPLIANCES

Grade Level 2-3

Purpose: To determine "necessary" and "luxury" home electrical appliances.

Concept: Energy, it's production, use, and conservation are essential in the maintenance of our society as we know it.

Materials: Pencil or pen

Activity:

Although home appliances only consume 5.8% of the total energy consumption of the nation, energy awareness may need to start with some small inconveniences. Mark with a plus (+) those measures on this list which you would be willing to take:

- _____ Give up your electric can opener. Open a can by hand.
- _____ Towel dry and air dry your hair; no electric rollers, blowers or curlers.
- _____ A little "elbow grease"; hand mix ingredients.
- _____ On a sunny day hang out laundry to air dry.
- _____ Puree by hand not with a blender.
- _____ Plan home entertainment. Use T.V. or radio only a few hours a day.
- _____ Walk up and down stairs rather than use elevators and escalators.
- _____ Stop using your electric garbage disposal.
- _____ Bring aluminum containers back for recycling.

ENERGY HABITS GAME

Grade Level 2-3

Purpose: To emphasize good (+) and bad (-) energy habits.

Concept: Energy, its production, use, and conservation are essential in the maintenance of our society as we know it.

Reference: Environmental Education: Strategies for Wise Use of Energy, North Carolina State Department of Public Instruction, Raleigh, North Carolina.

Activity:

Through this simple board game, students will become aware of efficient energy-usage.

1. Make a game board for every four students.
2. Obtain dice and make place markers for each team.
3. Make positive and negative cards for energy-usage actions. Positive cards indicate efficient practices and negative cards indicate wasteful practices.
4. Roll the dice and move the number of spaces you roll. If a message is on the square, do what it indicates.
5. The winner is the person who gets to the land of Energy-Wise first.
6. After game, discuss how people have different values and attitudes toward energy and the environment.

Energy Cards:

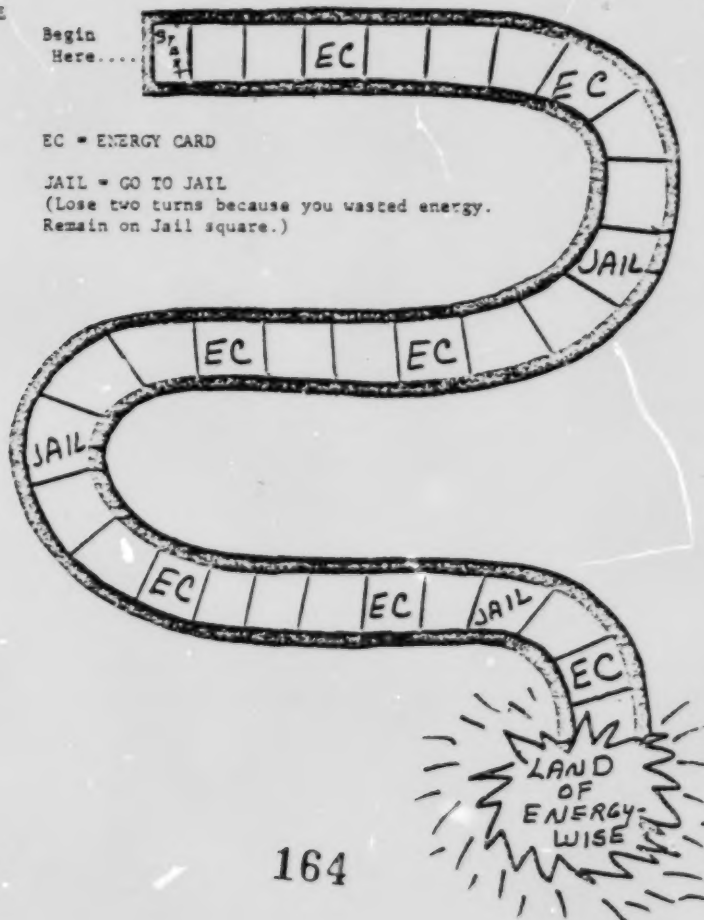
Sample cards: Forward (+); Backward (-)

Energy Cards - Group A: Answer yes - move forward
Answer no - stay where you are

- +2 if you turned off the light
- +4 if you walked to school or rode your bike
- +1 if you took a shower instead of a bath
- +1 if you closed the refrigerator door
- +3 if your family owns a small 4-cylinder car
- +2 if your thermostat is set at 68° or lower to heat
- +4 if your family has no air conditioning
- +2 if you use fluorescent tubes instead of incandescent bulbs

- 3 if you use an electric toothbrush
- 2 if you use an electric blanket
- 4 if your house has no storm windows or storm doors
- 3 if you have a dripping hot water faucet at home
- 4 if your family has a big car
- 4 if your family has a color TV with instant-on
- 2 if you have a self-cleaning oven at home
- 1 if you have an electric knife in use
- 1 if there's an outside light burning during the day at home
- 4 if you leave the TV playing when you leave the room

JAIL = GO TO JAIL
(Lose two turns because you wasted energy.
Remain on Jail square.)



NEEDS AND WANTS

Grade Level K-3

Purpose: To discover the difference between "needs" and "wants".

Concept: The relationships between man and the natural environment are mediated by his culture.

Reference: "Living Within Our Means: Energy and Scarcity", Environmental Education Instructional Activities K-6, State Department of Education, Albany, New York.

Activity:

Man, like other animals, has certain basic needs which must be met if he is to survive. Beyond these, the things that he acquires and uses reflect his wants and desires. Have the children either draw or cut out pictures of "Things We All (Really) Need" and "Things We Would Like To Have". Assemble the pictures according to these two categories and display them.

- Which pictures or drawings show things that all boys and girls everywhere in the world need?
- Why does everyone need them?
- Are there some things that people in the United States really need that other people in the world do not? Explain.
- How does the size of a country's population affect how well their needs are taken care of?

Have the children examine the second group of pictures, those things which they would like to have (nonessential or luxury items). Determine whether children have essentially the same wants.

- Why are there differences in the things you want?
- Can we get all of the things we want all of the time? Why, or why not?
- Why is sharing important and necessary?
- What are some rules you would make to insure that everyone got his "fair share"? What do we mean by "fair share"?
- Using things that we do or things we have in the classroom as examples, show how sharing can benefit everyone and satisfy many of our needs.

SOCIOLOGY/PSYCHOLOGY/PHILOSOPHY

Grade Level 1-3

Purpose: To become aware of the social aspects of the energy problem.

Activity:

1. In what ways might our nation benefit from the energy crisis? Can you classify benefits under headings of social, economic, political, environmental, and moral?
2. Compare the lifestyle in an underdeveloped nation with your own. Consider the energy consumed by both and discuss the differences.
3. Estimate the minimum amount of energy you would need for bare existence.
4. When people get angry or upset, or even when they feel really good, there is usually one thing or person that makes them feel that way. Make a list of things related to the energy situation that affect your emotions.
5. A "traditional value" in this country has been that if something can be done, it ought to be done. Discuss what would happen if that value were changed to become: "The value of a process or product must be based on the extent to which it creates the greatest social good." What implication(s) would this have for policy-makers? How would it affect the growth of some industries? Where does energy fit into this picture?



AN ENERGETIC GAME!
(Bingo)

Grade Level 2-3

Purpose: To review cognitive information presented in previous lessons.

Materials: Bingo Handout Sheets

Activity:

The games included here are examples of the format that might be employed at the culmination of any unit on energy. You can construct your own game by substituting clues and corresponding answers that are suitable to the content and level of difficulty you have covered.

Distribute a mimeographed copy of the 16-square card to each student. Ask the student to cut out the squares and rearrange them in any order he/she wishes. This is essential if students are not all to attain "BINGO" at the same time. The squares should then be glued onto another sheet of paper.

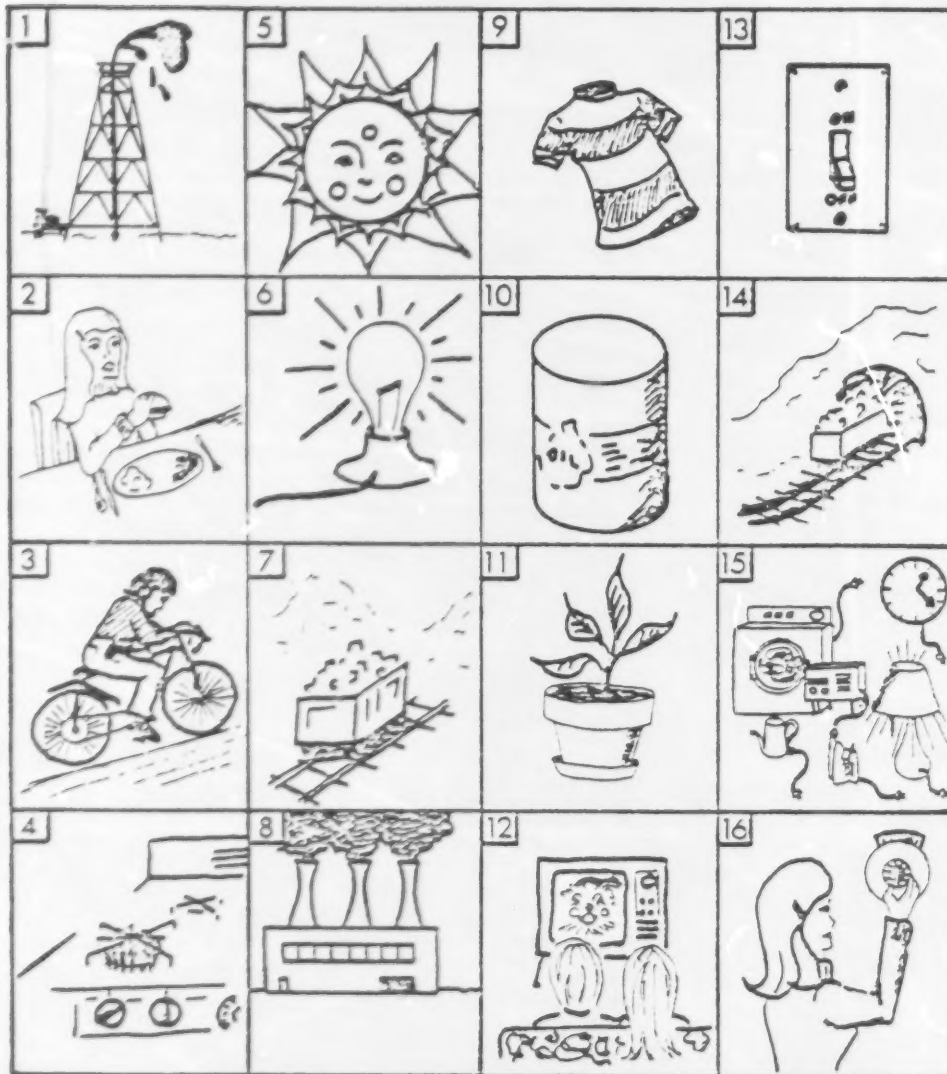
Either a student or the teacher can be the "caller" and read the energy-related clue to the other students. Do not read the numbers of the clue. The clues may also be cut out and chosen randomly from a box by an assistant.

As the clue is read, the players will mark the answer on their card with an "X". The first player to get four boxes in a row is the winner and should call out "BINGO". The teacher should very quickly check his answers to be sure they are marked correctly. If the student was not correct then he is eliminated and game continues.

As a follow-up activity, divide the class into small groups. Each group of students should prepare another set of 16 clues and answers that can be duplicated for the remainder of the class. The group who composed the clues and answers would administer the game.

PRIMARY BINGO

(Duplicate a copy for each student. Have students cut into squares and glue in differing order on another sheet of paper.)



Example for Primary Grades

BINGO CLUES

(Do not mention number!)

1. This is how we get oil out of the ground.
2. When we do this we are making more energy for our body.
3. We use muscle energy when we do this.
4. This gives us heat energy.
5. Our greatest source of energy in nature.
6. This gives us light energy.
7. This fuel can be mined and used to produce electricity to light our homes.
8. Factories that use a lot of fuel and energy sometimes create this problem.
9. Oil and gas help to make this product.
10. This is the liquid fuel that heats some of our homes, helps make our cars run, and does many jobs in our homes.
11. These need energy from the sun in order to grow.
12. When we watch this for too long, we use a lot of electric energy.
13. This turns the electric power on and off in our house.
14. A place where coal is mined.
15. Too many of these in our home use a great deal of electric energy.
16. This is one way to save heat energy.

BINGO Scoreboard
(Intermediate Level)

(Duplicate a copy for each student. Have students cut into squares and glue in differing order on another sheet of paper.)

1 SUN	5 COAL	9 NUCLEAR	13 STRIP MINING
2 COAL, NATURAL GAS	6 GEOTHERMAL	10 URANIUM	14 GREEN PLANTS
3 ELECTRICITY	7 NATURAL GAS	11 WELLS	15 GASOLINE
4 OIL	8 MINES	12 WIRES	16 FOOD

Example for Intermediate Level

BINGO ENERGY CLUES

(Do not mention number!)

1. The major source of energy found in nature.
2. The three fossil fuels are oil, _____, and _____.
3. Most of the appliances in our homes are powered by _____.
4. A fossil fuel that is in liquid form.
5. An energy source that is obtained from deep or surface mines.
6. Energy source in the form of steam.
7. The fossil fuel that has the shortest predicted life span is _____.
8. Black lung disease was obtained by working in _____.
9. The name of the energy that results from splitting an atom.
10. The fuel that is used to produce nuclear energy.
11. Natural gas and oil are obtained from the ground with _____.
12. Electricity is transmitted to our homes through _____.
13. The process of removing coal from the surface of the earth is called _____.
14. Most food items are obtained from, or can be traced back to _____.
15. One of the products of an oil refinery is _____.
16. Humans obtain their energy from _____.

METER READING

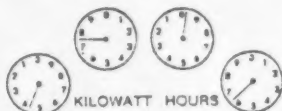
Grade Level K-3

Objective: To teach students to be able to read their home gas and electric meters

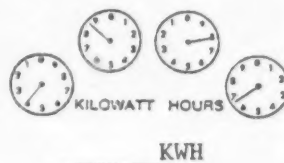
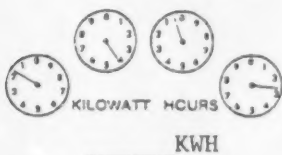
Activity: Students will take readings from meters at home, copy the position of the pointers on the dials and bring to school. The following exercises should help them to read their own meter.

1. Electric meters measure the amount of electricity used ~~for~~ your home. The greater the amount of electricity used, the more rapidly the pointers move. The meter is affected by the amount of current flowing into your house and the voltage or pressure it is under.

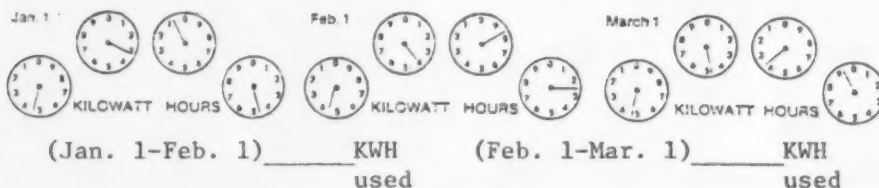
Most meters have four or five dials. The dials are read from left to right and measure kilowatt-hours (a 100-watt light bulb burning for one hour uses 100 watt-hours of electricity--a kilowatt-hour is 1000 watt-hours). When the pointer is between two digits, always read the smaller. For example, the following dials would be read 4796 KWH.



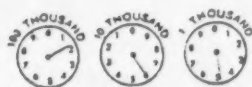
What is the reading of each of the following electric meters?



Find the cost of the electricity consumed during the month of (1) January and (2) February at the rates given on the rate schedules following this activity if the meters were read on



2. The gas meter is read in a similar manner, except that it measures cubic feet of gas consumed. For example, the following meter would be read: 164,000 cu. ft.



Cubic Feet

What is the reading of each of the following gas meters?

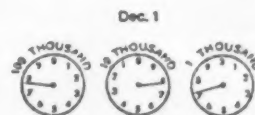
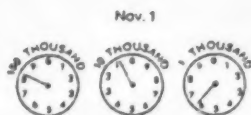
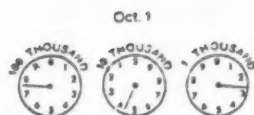


_____ Cubic Feet



_____ Cubic Feet

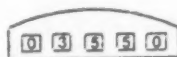
Find the cost of the gas consumed during the months of (1) October and (2) November at the rates given below if the meters were read on:



(Oct. 1-Nov. 1)
_____ Cubic Feet

(Nov. 1-Dec. 1)
_____ Cubic Feet

3. Digital meters--some large consumers have digital meters. An example is:



- Extended Activities:
- Students may try to figure out why adjacent dials rotate in opposite directions.
 - Students may build a model meter out of wood, cardboard, etc.
 - A meter is a small induction motor. Students may be assigned to explain the theory behind the operation of the meter.

ELECTRICITY RATES
(OG&E, Oklahoma City)
(June 29, 1977)

Residential

Summer:

First	16 KWH	--	\$1.04
Next	24 KWH	--	.04107/KWH
Next	100 KWH	--	.03607/KWH
Next	460 KWH	--	.02407/KWH
Next	900 KWH	--	.02157/KWH
Next	1000 KWH	--	.02107/KWH
Over	2500 KWH	--	.01807/KWH

Winter:

First	16 KWH	--	\$1.04
Next	24 KWH	--	.04107/KWH
Next	100 KWH	--	.03607/KWH
Next	460 KWH	--	.02407/KWH
Next	1900 KWH	--	.01307/KWH
Over	2500 KWH	--	.01207/KWH

To determine total billing, calculate base costs for KWH used from above schedule; to this amount add (number of KWH used x *\$.009897/KWH); then add State and City Sales Tax to this subtotal. In some areas there is also a franchise amount (1 percent in Oklahoma City) to be added to determine total billing.

*Fuel adjustment factor

GAS RATES
(ONG, Oklahoma City)
(June 14, 1977)

1 MCF = 1000 Cubic Feet

Summer Residential Rates:

First	MCF	\$2.43
Second	MCF	1.50
Third	MCF	1.50
Next	4 MCF	1.280/MCF
Next	13 MCF	1.080/MCF
Next	80 MCF	1.104/MCF
Next	100 MCF	1.004/MCF

To determine total billing, calculate costs for MCF consumption from above schedule; to this amount add (consumption in MCF x *\$.626); then add State and City Sales Tax to this subtotal.

*Field adjustment price

SUPPLY AND DEMAND

Grade Level K-3

Purpose: To show how supply and demand affects price.

Concept: To maintain an acceptable (wants and needs) standard of living and preserve our environment, we must conserve our available energy resources while we are developing alternate energy sources.

Source: Jerry Shaw, Science Teacher, Stillwater, Oklahoma.

Materials: Candy bars (or other commodity)

Activity: Procedure--

1. Choose two, five-member teams of students telling them that it takes money to play this game.
2. Explain to the students that you have nine candy bars (one less candy bar represents a certain limited commodity (energy, food, natural resources or any other you may be discussing). In order for a team to win, at the end of the game, each member of that team must have at least one candy bar.
3. Auction off the candy bars.
4. As the supply decreases and the demand increases, the price will increase.
5. When the game is over the candy bars can be taken up and the money refunded, if desired.

Many variations can be made on this plan. What happens to the price when there is a surplus? What happens when prices are controlled at a low level?

ENERGY/ENVIRONMENT

Grade Level 3

Purpose: To become aware of energy/environment relationships.

Activity:

1. Some nuclear power plants have been delayed because of actions taken by environmental groups. Some people feel that these environmentalists have been overzealous in their objective of halting nuclear power plant construction. Yet the environmentalists feel that the power companies, in their drive to provide electrical power, are avoiding the larger issues such as safety against major accidents and ecological damage. Whose argument (side) do you support and why?
2. What other conflicts are likely to arise as we struggle to meet demands for fuel and to protect the environment? Cite specific examples, such as undesirable side effects from burning coal.
3. Do you believe that the energy shortage has any influence upon or is in any way connected to the concerns about the environment?
4. When you turn on a light, do you ever think about ecological interactions (i.e., what operations are necessary to produce the illumination at the flick of a switch)?
5. When coal is mined and sold, is its full cost reflected in its selling price? Are there any "costs" left behind, such as black lung disease, ruined farmland, silted water? How big are these costs? How much would coal and electricity prices be affected if we got rid of the health and environmental costs through improved regulations?